Los Alamos
NATIONAL LABORATORY
EST.1943

LA-14208-PR Progress Report
Approved for public release; distribution is unlimited.

D Division unfolds inside...

Decision Applications Division

2005 Progress Report

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.

Decision Applications Division

2005 Progress Report

LA-14208-PR Progress Report • Issued March 2005

Los Alamos
NATIONAL LABORATORY
EST. 1943

Abstract

The Decision Applications Division (D Division) 2004-2005 Progress Update summarizes substantive work completed by D Division staff members in 2004. This update supplements the Decision Applications Division 2003–2004 Progress Report. The update is primarily technical in nature. Included in the report are summaries of each group's academic focus and of specific projects, a brief look at the Division's financial and workforce statistics, and a list of publications. This update is directed toward for the D Division Division Review Committee, which reviews and certifies the Division technical acumen.

Additional information can be obtained by contacting the D Division Office at **(505) 667-4567** and by viewing the D Division Web site at **http://www.lanl.gov/orgs/d/**.

The previous report in this unclassified series is LA-14120-PR.

Acknowledgements

Project Management and Compilation
Debby Thompson
Project Technical Management
Venkateswara R. Dasari (D.V. Rao)
Writing and Technical Editing
Lisa Inkret
Graphic Design, Illustration, and Layout
Rich Leishman
Photography
Richard Robinson, Michael O'Keefe, and LeRoy Sanchez
Proofing
Nikki Goldman
CD Generation
Sandra Valdez

Contents

Decision Applications Division

Division Overview

Decision Applications Division—An Overview

FROM THE D DIVISION LEADER

This past year has been very rewarding and exciting for the Decision Application (D) Division, despite the operational challenges we faced. Concerned with escalating Lab-wide safety and security incidents, the Laboratory suspended all operations and asked us to identify operational vulnerabilities related to safety, security, and compliance. Micheline Devaurs left her position as Division Leader initially to assist in resumption activities for the Nuclear Weapons Systems Analysis Office and then to lead the Strategic Research Directorate.

Although this suspension required considerable staff time away from the technical work, it also allowed us to transform our operations as never before. For example, we have streamlined our classified computing operations to the extent that we now have a state-of-the-art classified network that enhances our connectivity to the external world and allows us to carry out operations in a more secure and efficient environment, without the need for classified removable electronic media (CREM). It is also worth noting that D Division was one of the first divisions to fully resume operations after the work suspension and that meant we were able to meet most programmatic milestones.

We have made significant strides in the past year in developing and executing nationally significant programs that continually improve quality of science. As a member of the Threat Reduction Directorate, homeland security, nonproliferation and intelligence activities continue to be a core part of our mission. We contributed significantly to several national programs including second line of defense, megaports and BASIS – all aimed at deterring or effectively responding to threats from weapons of mass destruction (WMD). We advanced underlying science including stochastic network interdiction, sensor siting, and sensor data acquisition, handling, and analysis.

D Division also continues to lead the National Infrastructure simulation and Analysis Center (NISAC) program, and this year we accomplished a major milestone when the NIASC set of tools became operational. We both strengthened and expanded our role in support of nuclear weapons (NW) programs to include enterprise stockpile systems modeling and Robust Replacement Warhead (RRW) Phase I studies. Our role in quantification of margins and uncertainties has contributed directly to meeting Appendix F milestones. We are now the host for the Defense Transformation Study Group and are expanding our portfolio of Department of Defense (DoD) programs related to systems integration and decision modeling. D Division continues to be the Laboratory technical lead in nuclear energy programs, and our portfolio of nuclear energy programs increased to nearly $15M and includes the most recognized space nuclear program. Among the initiatives, Knowledge Discovery and Dissemination (KDD) and Horizontal Integration are starting to pay significant dividends.

In all, it has been a rewarding experience for me personally to lead such a diverse organization with acknowledged expertise in decision support technologies that are so vital to the Laboratory and the nation. We accomplished our operational transformation thanks to our commitment to operational excellence and belief in our core values. ■

OUR VISION

Create enhanced decision processes by integrating science, engineering, and technology and apply them to critical Laboratory and national decisions.

OUR MISSION

Through science-based, multidisciplinary assessments, enable important national security decisions pertaining to the safety and reliability of the U.S. nuclear deterrent, national critical infrastructure protection and homeland security, national defense transformation, and nuclear energy and environment.

OUR CORE VALUES

Excellence in science and technology, good stewardship of our programs, the academic and cultural diversity of our workforce, and local and national community outreach.

DECISION APPLICATIONS DIVISION

The Decision Applications (D) Division is the science-based decision analysis arm of the Los Alamos National Laboratory (LANL). In fact, decision analysis capabilities are the unique thread of continuity that binds this otherwise diverse division of almost 300 employees together. The S&T base of D Division is instrumental in enabling important institutional and national decisions that have a direct impact on our national security. In addition, D Division's Department of Defense (DoD) Program Office also plays a leading role in developing, coordinating, and executing DoD-sponsored research and development across the Laboratory.

Decision analysis, in the context of D Division, creates enhanced decision processes through integration of science, engineering, and technology and applies those processes in support of critical Laboratory and national decisions. D Division's broad-based S&T capabilities are vital to carrying out the multidisciplinary assessments that are an essential component of decision analysis of complex systems. These capabilities are what makes D Division unique at Los Alamos.

Construction continues on the National Security Sciences Building at TA-3 at the Los Alamos National Laboratory.

We maintain and continually upgrade our capabilities by recruiting well-published staff, engaging in cooperative research with visiting faculty and students, and by actively participating in Laboratory Directed Research and Development (LDRD) programs.

The Decision Application (D) Division has seven core capabilities.

Computational Science

Computational science contributes to fundamental scientific understanding by applying computer-based representations to scientific and engineering problems. This work complements the traditional mechanisms of theory and experimentation in the scientific method. One of the Division's unique capabilities is bringing together theoreticians and practitioners to translate ideas from theory to reality.

Modeling and Simulation

The modeling and simulation capability develops algorithms, models, and other software components to represent and study actual or theoretical systems of interest. The Division delivers these as products in their own right or uses them in support of our analyses.

Engineering

Engineering is a strong component of D Division's skill set, with fields ranging from nuclear weapons and manufacturing processes engineering to infrastructure reliability and safety engineering. Our engineers' abilities to work closely with modeling and simulation experts gives us a special insight that we can apply to designing advanced nuclear reactors for space exploration and to advancing homeland security technologies.

Operations Research/Systems Analysis

Practitioners of operations research/systems analysis (OR/SA) develop and apply tools and methods to understand the behavior of complex systems. The goals are to provide a rational basis for decision-making, to predict system behavior, and improve system performance.

Statistical Science

Distinguished by its multidisciplinary nature, statistics is the science of extracting scientifically meaningful qualitative and quantitative information sets and learning from data of all types. The ultimate goal is to support decision making under uncertainty, from decisions about basic scientific phenomena to public policy.

Qualitative Analysis

Qualitative analysis refers to an interdisciplinary set of computational and descriptive techniques and tools used to understand problems and develop solutions in domains that are inherently difficult to quantify. Included are different methods for eliciting, representing, and integrating information from diverse sources.

Nuclear Science and Engineering

Within D Division, nuclear science and engineering involves both developing nuclear analysis tools and utilizing analysis tools to design advanced or special purpose fission systems and to solve complex problems associated with nuclear systems.

The D Division staff apply these capabilities to basic and applied national security problems. We conduct objective, quality systems studies; engineering analysis; and safety, hazard, and risk assessments in the areas of critical infrastructure (transportation, communications, power, financial, and natural systems) assurance, military systems, and exploitation of nuclear systems for national needs.

Division Thrust Areas
Nuclear Weapons

About a decade ago, the United States stopped producing new nuclear weapons, resulting in an aging stockpile. Nuclear weapons testing also ended, making it more difficult to assess the safety and reliability of that stockpile. Today we need improved analytical methods and tools to manage this overly committed and constrained weapons program. To support the nuclear weapons programs, the Division provides a broad array of technical capabilities such as programmatic management and integration, project risk analysis, uncertainty quantification, reliability assessment, manufacturing process planning and analysis, nuclear safety analysis, systems analysis, statistical analysis, stockpile planning, and surety and facility planning. Our work is critical to both the short- and long-term success of the Lab's nuclear weapons program.

D Division currently supports a multitude of projects in the nuclear weapons arena. The nuclear weapons programmatic funding base is approximately $25M. Our goal is to be recognized as a partner in the Laboratory's nuclear weapons program and to provide decision support to all aspects of the program. The major long-term objective is to integrate the Division into the decision-making structure of the Lab's nuclear weapons program. To that end, we will focus on building responsive teams that support the vision; supporting the established nuclear weapons programs with our Division's unique decision support assets; aggressively developing new programs and projects in the nuclear weapons arena; teaming with other divisions and leading by example; supporting division/sister-group led projects with appropriate resources; and maintaining professional and career development for all staff.

Threat Reduction

The 9/11 World Trade Center attacks raised concerns about our nation's ability to prevent and respond to terrorist threats and underscored the need for integrating our nation's disparate pieces of information (e.g., knowledge, discovery, and dissemination). D Division is developing technologies to protect our critical infrastructures from asymmetric threats, including threats from WMD. We collaborate closely with ISR, B, and N Divisions. One of our long-term objectives is to maintain D Division as the national center of excellence for modeling and simulating critical infrastructure interdependencies.

NISAC provides fundamentally new modeling and simulation capabilities for analyzing critical infrastructures, their interdependencies, vulnerabilities, and complexities. We apply our modeling, simulation, and systems analysis capabilities to designing optimum strategies to assess, mitigate, and respond to threats from WMDs.

D Division is also a national center of excellence in biosurveillance. This role is evidenced by the fact that several cities use our technologies to monitor and respond to radiation, nuclear, biological, and chemical threats. We are actively working to advance our technologies through collaborative research sponsored jointly by the Department of Homeland Security (DHS) and the Defense Threat Reduction Agency (DTRA).

D Division also serves as the systems integrator for several nuclear sensor deployments, contributing directly to the successful execution of the Second Line of Defense (SLD) and Megaports programs. We have advanced the underlying scientific methods, including stochastic interaction modeling and sensor data acquisition, handling, and analysis. These advances will aid us in developing future system architecture for sensors to be deployed over the continental United States (CONUS).

Energy and Environment

D Division has a strong background in the safety, security, and environmental aspects of nuclear energy. We support critical regulatory, policy, and planning decisions for our customers, and our programs support the Nuclear Regulatory Commission's (NRC) Offices of Research, Reactor Regulation, and Nuclear Materials Safeguards and Security. We also support the Advanced Fuel Cycle Initiative for the DOE Office of Nuclear Energy. We are a national center of excellence for design and analysis of compact nuclear reactors.

The scientific foundation of this research is grounded in our technical expertise. Important current Division research activities include assessing vulnerabilities to terrorist threats in the nation's nuclear energy facilities, space nuclear reactor design and technology development, and systems modeling of advanced fuel cycle options.

DoD/Conventional Defense

As the DoD applies technologies to transforming defense, the Laboratory is playing a growing role in providing innovative science and technology solutions for conventional defense strategies. The Defense Transformation (DT) and Horizontal Integration (HI) initiatives require complex decisions regarding technology selection and qualitative modeling. This presents unique opportunities for D Division to re-establish itself as the integrator of defense systems and technologies developed across the Laboratory and across the country. Our DoD Program Office works diligently to develop programs in these areas, leveraging our existing capabilities. The program office also oversees the Defense Science Studies Group and the Service Academy Research Associates Program, which are our internal and external outreach programs.

Workforce Excellence

D Division has a workforce staffing plan that involves division and group managers, furthers the D Division strategic and group business plans, and implements the Division's strategic hiring process. We encourage diversity in scientific approach and team membership and foster a work environment that encourages creativity, academic freedom, fair evaluation of ideas, and celebration of achievements. We encourage professional development through mentoring, discipline associations, training, peer review, publications, and presentations. The framework for workforce planning includes identifying strategic staffing needs based on our Division's thrust areas and group business plans. Core capabilities are reviewed and critical skills are identified as needed to enhance the Division's core capabilities in concert with thrust area goals. D Division strives to hire a new generation of scientists who will increase our technical depth across disciplines.

Facilities and Infrastructure

The Decision Applications Division has developed a Facility Strategic Plan (FSP) that supports long-range facility planning from an institutional and division perspective. The plan addresses all major mission activities in D Division. The Division envisions a future where its employees are concentrated at one major facility. Consolidation will improve interactions between scientists from various divisions (CCS, X, T, N, and ISR) collaborating on issues.

The plan includes consolidating existing facilities to achieve cost savings, new construction to accommodate projected mission needs, and needed upgrades to improve reliability and availability of facilities.

The D Division FSP prioritizes several scenarios ranging from participation as an occupant of the proposed Los Alamos Science Complex (LASC) to a series of renovation and general plant projects. D Division's long-term strategy would be to consolidate the entire division, including classified and unclassified work, at the LASC using third-party financing. The Division has confirmed an agreement with the Strategic Research Directorate to be included in Phase II of the LASC project and is prepared to join the process of initial requirements definition.

At the highest level, this FSP, when implemented, will support Division strategies for program elements including

- Growing our portfolio and becoming a strategic partner to the Nuclear Weapons Program
- Integrating the DoD Program with D Division systems analysis
- Integrating the homeland security portfolio, focusing on the application of D Division capabilities, to solve national problems
- Focusing the energy and environment program on nuclear reactor applications, nuclear fuel cycle initiative, and systems analysis to support national energy and environmental programs, and
- Developing a research program that supports both ongoing products and new capability development.

We continue to nurture our D Division Visualization Laboratory, which provides high-performance graphics processors and a large-screen, stereo-enabled project environment. This capability greatly enhances our contributions to the homeland security work of the Laboratory by providing tools that are applied to problems ranging from data flow architecture and traffic simulations to energy interdependencies and potential terrorist activity.

The Division has also made great progress in implementing a state-of-the-art, secure network that provides diskless computing and more timely and efficient collaborations among our technical staff in support of the Nuclear Weapons Program. In support of this effort, D Division was one of the first organizations to consolidate all of its classified media holdings into a CREM library.

D Division is committed to a safe and secure working environment for the technical staff, and certainly the efforts described in this section have enabled our staff to continue to meet their technical goals in support of the Laboratory's mission.

SPECIAL RECOGNITION

The continued commitment of the D Division workforce is recognized significantly by the external community. Among others, this year **Sallie Keller-McNulty** of the Statistical Sciences (D-1) Group was elected president of the American Statistical Association (ASA). Sallie will serve a three-year term, including president-elect in 2005, president in 2006, and past president in 2007. One of Sallie's main efforts as president will be to foster an infrastructure within the ASA that strongly links the statistical sciences' industrial and research laboratory communities with the academic sector and the national institutes. Sallie became an ASA Fellow in 1997 and has held several positions within the association, including winning the Founders' Award in 2002. With more than 17,000 members, ASA is the largest professional statistical association in the world.

Harry Martz, Jr., and **Michael Hamada** of the Statistical Sciences group are joint winners of the 2004 Distinguished Licensing Award. They are the principal team members in an ongoing collaboration with Procter & Gamble to develop innovative manufacturing reliability methods and systems. The Distinguished Licensing Award recognizes innovators who proactively engage in commercialization activities at Los Alamos and who have had a positive impact on the Laboratory's Licensing Program. These individuals, by example, demonstrate outstanding success in transferring Laboratory-developed technologies to the public and private sectors. In addition, the recipients' commercialization track record has enhanced the reputations of both the University of California and the Laboratory. Nominees for this award are evaluated based on ongoing active engagement in the licensing process; active participation in the promotion of their technologies; number of technologies licensed; number of licenses per technology; and support for multiple uses of the licensed technologies (private and public). ■

Decision Applications Division

2005 Division Review Committee

2005 Division Review Committee

THE COMMITTEE

The 2005 Decision Applications Division Division Review Committe members are

Per F. Peterson (Committee Chair)

UC-Berkeley, Professor and Chair, Department of Nuclear Engineering

Professor Peterson manages the UC-Berkeley Thermal Hydraulics Research Laboratory. His research focuses on problems in energy and environmental systems, including inertial confinement fusion, advanced light water reactors, high-level nuclear waste processing, and nuclear materials management. Professor Peterson has served on the UC-Berkeley College of Engineering strategic planning committees, as well as chairing the College Committee for Undergraduate Studies. He has contributed to the *Journal of Heat and Mass Transfer* as an associate editor and currently serves as an editor for *Experimental Heat Transfer*. From 1996–1997, Dr. Peterson served as chairman for the Thermal Hydraulics Division of the American Nuclear Society. As a consultant, he contributed to the design of the Westinghouse AP-600 advanced reactor. He received a Ph.D. from the University of California-Berkeley in 1988.

Paul Bracken

Yale University, Professor of Management and Political Science

A former visiting professor at Beijing University, Dr. Bracken teaches courses on international strategy and organization, global technology management and innovation, and building competitive advantages through information technology. Before joining the Yale faculty, Professor Bracken was on the senior staff of the Hudson Institute for ten years, a think tank where he worked closely with the late Herman Kahn, its founding director. Professor Bracken is a member of the Council on Foreign Relations as well as the International Institute for Strategic Studies. Professor Bracken has a Ph.D. in operations research from Yale University.

Geoffrey Fox

Syracuse University, Professor of Physics and Computer Science, Director of the Northeast Parallel Architectures Center

Dr. Fox received a Ph.D. in theoretical physics from Cambridge University and is now professor of computer science, informatics, and physics at Indiana University. He is director of the Community Grids Laboratory of the Pervasive Technology Laboratories at Indiana University. He previously held positions at Caltech, Syracuse University, and Florida State University. He has published over 400 papers in physics and computer science and has been a major author on four books. Dr. Fox has worked in a variety of applied computer science fields, with his work on computational physics evolving into contributions to parallel computing and now to grid systems. He has worked on the computing issues in several application areas—currently focusing on earthquake science.

Stephen J. Guidice

Independent Consultant

Mr. Guidice has a broad range of senior executive service government experience in managing complex technical programs and integrating the activities of diverse organizations,such as the three Department of Energy (DOE) nuclear weapons laboratories, seven large commercial contractors operating DOE nuclear weapon production plants, the Department of Defense, and foreign governments. He received his B.S. in engineering and M.S. in management from the Rensselaer Polytechnic Institute in Troy, NY.

Charles M. Herzfeld

Senior Associate, Center for Strategic and International Studies

Dr. Herzfeld has served as Director of the Advanced Research Projects Agency when the ARPAnet was started, as Vice President for Research and Technology at ITT Corporation, Director of Defense Research and Engineering in the Department of Defense, and senior consultant to the Science Advisor of the President. He has been a member of the Chief of Naval Operations Executive Panel since its formation in 1970, and has served on the Defense Science Board and the Defense Policy Board. He has testified frequently before Congress and written and lectured on the subjects of defense technology and policy, information technology and high-performance computing. Dr. Herzfeld has a Ph.D. from the University of Chicago in physical chemistry.

Raymond J. Juzaitis

Lawrence Livermore National Laboratory: Chief Scientist, Nonproliferation, Arms Control, and International Security Directorate

Dr. Juzaitis' most recent position was Associate Director for Weapons Physics at Los Alamos, before moving to Lawrence Livermore National Laboratory in February 2004. During his tenure as Associate Director at LANL, Dr. Juzaitis was responsible for the nuclear weapon physics design and assessment effort, including Lab-wide science activities that contribute most directly toward the science-based certification of nuclear weapon performance and safety. He began his career at Los Alamos as a technical staff member in radiation transport in X-6, later moving to X-4 to participate in nuclear weapon design and testing. He served as a member of the W88 design team and later was design team leader for the primary design of the Strategic Earth-Penetrator warhead. Throughout his career at LANL, Dr. Juzaitis served as Deputy Division Leader in J Division, X Division Leader, and concurrently as the Director for the National Hydrotesting Program and Deputy Associate Laboratory Director. At Livermore, he is actively involved in developing an end-to-end systems architecture for the interdiction of unconventional nuclear and radiological threats to national security. He is Executive Staff Director for a proposed DHS-sponsored Winter Study addressing these threats.

Dr. Jon R. Kettenring

Former Executive Director of the Mathematical Sciences Reseach Center at Telcordia Technologies

Dr. Kettenring joined Telcordia in 1983 after 15 years in the Statistics and Data Analysis Research Department at Bell Laboratories, where he engaged in and supervised statistics research.x. He is a Fellow of ASA and AAAS and an elected member of the International Statistical Institute. He has represented a "statistics in industry" perspective in a variety of national and international assignments. These include President of the American Statistical Association, Member of the Board on Mathematical Sciences of the National Research Council, Chair of the Board of Trustees of the National Institute of Statistical Sciences, and Member of the Board of Directors of the Interface Foundation of North America. He is currently a Fellow at Drew University in Madison, NJ.

Dr. Kettenring has a B.S. and M.S. in statistics from Stanford University and a Ph.D. from the Univesity of North Carolina.

Nozer D. Singpurwalla

George Washington University/ Professor of Operations and Statistics Distinguished Research Professor

Dr. Singpurwalla has been a visiting professor at Carnegie-Mellon University, Stanford University, the University of Florida-Tallahassee, and the University of California at Berkeley. During 1991, Dr. Singpurwalla was the first C.C. Garvin Visiting Endowed Professor in the mathematical sciences at the Virginia Polytechnic Institute and State University. He is a Fellow of the Institute of Mathematical Statistics, the American Statistical Association, and the American Association for the Advancement of Science, and he is an elected member of the International Statistical Institute. Dr. Singpurwalla's areas of expertise are applied probability and Bayesian statistics; reliability theory, warranties, and quality control; time series analysis; fault tree analysis; filtering theory; uncertainty in expert systems; and failure data analysis.

Dr. Singpurwalla received his Ph.D. in from New York University in 1968.

Robert J. Thomas

Professor of Electrical and Computer Engineering, Cornell University

During the 1979–1980 academic year, Dr. Thomas spent his sabbatical leave with the U.S. Department of Energy Office of Electric Energy Systems (EES) in Washington, D.C. In 1987 and 1988, he was on assignment from Cornell University to the National Science Foundation as the first Program Director for the Power Systems Program in the Engineering Directorate's Division of Electrical Systems Engineering (ESE). Dr. Thomas is the author of over 100 technical papers and two book chapters. He has been a member of the IEEE University States Activity Board's Energy Policy Committee since 1991 and was the Committee's Chair from 1997–1998. Dr. Thomas was a member of the IEEE Technology Policy Council, has served as the IEEE-USA Vice President for Technology Policy, and has been a member of several university, government, and industry advisory boards or panels.

His current technical research interests are broadly in the areas of analysis and control of nonlinear continuous and discrete time systems with applications to large-scale electric power systems. He is the founding director of the 11-university member National Science Foundation Industry/University Cooperative Research Center and the Power Systems Engineering Research Center (Pserc), a center focused on problems of restructuring of the electric power industry.

James Stanley Tulenko

University of Florida, Professor and Chair, Nuclear & Radiological Engineering

Professor Tulenko is a Fellow of the American Nuclear Society and has received many distinguished awards including the Mishima Award of the American Nuclear Society for Outstanding Research in the areas of nuclear fuels and materials, the Glen Murphy Award of the American Society for Engineering Education, Outstanding Nuclear Engineering Educator, and the Gordon McKay National Engineering Fellowship. He is currently on the board of the directors for the American Nuclear Society. His areas of interest are nuclear engineering, nuclear fuel management, nuclear waste, nuclear fuel manufacturing, systems engineering, radiation effects on materials, robotic maintenance in hazardous environments, and computer simulations.

John F. Ahearne

UC S&T panel liaison for the D, NMT, and ISR Division Review Committees

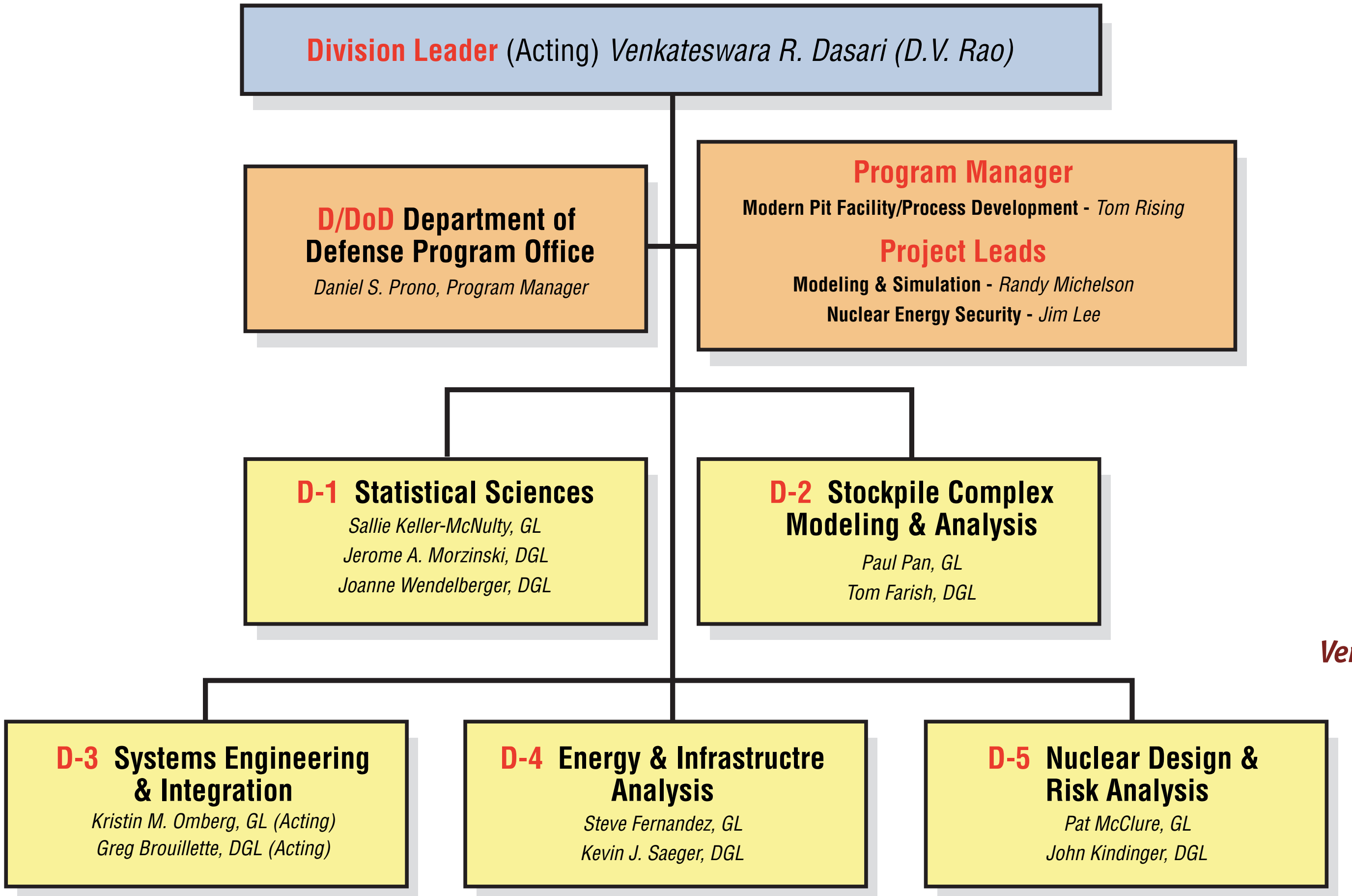
Dr. Ahearne is currently director of research ethics for Sigma Xi and lecturer at Duke University. Formerly, he served as chairman of the U.S. Nuclear Regulatory Commission; Deputy Assistant, Principal Deputy Assistant, and acting Assistant Secretary of Defense; Deputy Assistant Secretary of Energy; vice-president, Resources for the

Future; USAF, president, Society for Risk Analysis; chair American Physical Society Panel on Public Affairs; and chair of the American Physical Society Forum on Physics and Society. He is a member of the UC President's Council, chair of the National Security Panel, and a Fellow of American Physical Society, Society for Risk Analysis, and AAAS as well as a member of the American Academy of Arts and Sciences and National Academy of Engineering. He received a B. Eng. and and M.S. in physics from Cornell University and Ph.D. in physics from Princeton University. ■

Decision Applications Division

Group Overviews

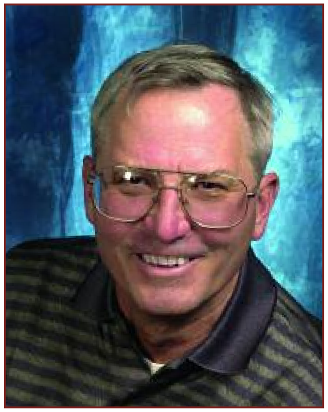
Decision Applications Division Organization



Decision Applications Division Organization Chart (2/05)

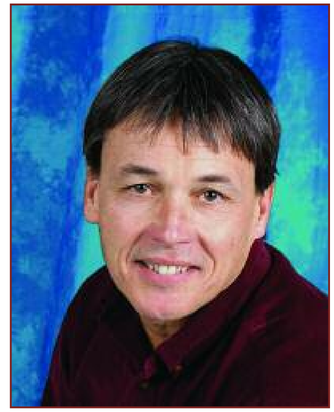
Venkateswara R. Dasari (D.V. Rao)
Division Leader, Acting
dvrao@lanl.gov

Decision Applications Division Management Team

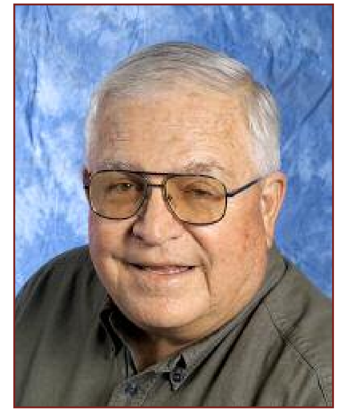


Daniel S. Prono
DoD Program Manager
dprono@lanl.gov

Tom Rising
MPF/Process Devel. Program Manager
rising@lanl.gov



Randy Michelsen
Project Lead Modeling & Simulation
rem@lanl.gov

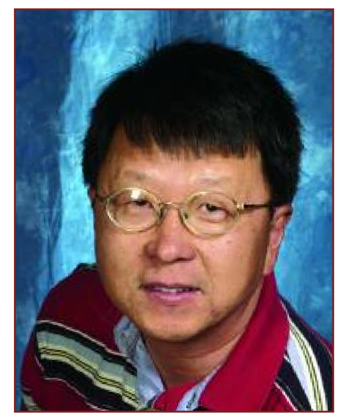


Jim Lee
Project Lead Nuclear Energy Security
jhl@lanl.gov

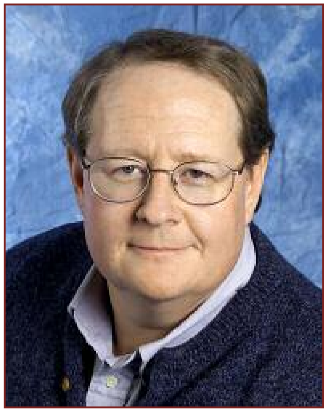
Sallie Keller-McNulty
D-1 Group Leader
sallie@lanl.gov

Jerome A. Mozinski
D-1 Deputy Group Leader
morzinski@lanl.gov

Joanne Wendelberger
D-1 Deputy Group Leader
joanne@lanl.gov

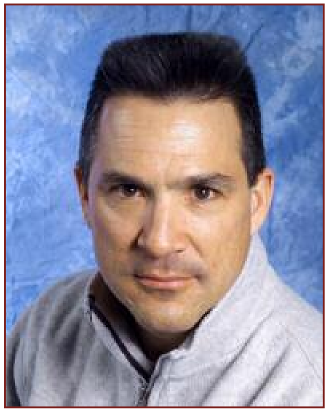


Paul Pan
D-2 Group Leader
ppan@lanl.gov

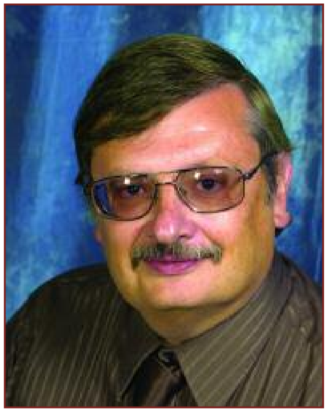


Tom Farish
D-2 Deputy Group Leader
tjf@lanl.gov

Kristin M.Omberg
D-3 Group Leader, Acting
komberg@lanl.gov



Greg Brouillette
D-3 Deputy Group Leader, Acting
greg_brouillette@lanl.gov



Steve Fernandez
D-4 Group Leader
sjf@lanl.gov

Kevin J. Saeger
D-4 Deputy Group Leader
saeger@lanl.gov

Pat McClure
D-5 Group Leader
pmcclure@lanl.gov

John Kindinger
D-5 Deputy Group Leader
johnk@lanl.gov

D-1 Statistical Sciences

The Statistical Sciences Group was formed in 1967 to enhance the quality of research at the Laboratory by providing a center of statistical excellence. We work with scientists, engineers, and policy makers both within and outside the Laboratory to bring statistical reasoning and rigor to multidisciplinary scientific investigations and apply them to problems of national importance. Our work includes developing, understanding, representing, and communicating cutting-edge statistical techniques for decision-making under uncertainty. The group has extensive experience in developing techniques for collecting, analyzing, combining, and making inferences from diverse qualitative and quantitative information sets such as experiments, observational studies, computer simulations, and expert judgment.

The group's core competencies include computationally intensive statistical methods, Bayesian methods, hierarchical methods, statistical reliability, uncertainty quantification, experimental design, spatial-temporal methods, degradation/aging methodology, Monte Carlo methods, applications of statistics to general science, and knowledge discovery and dissemination.

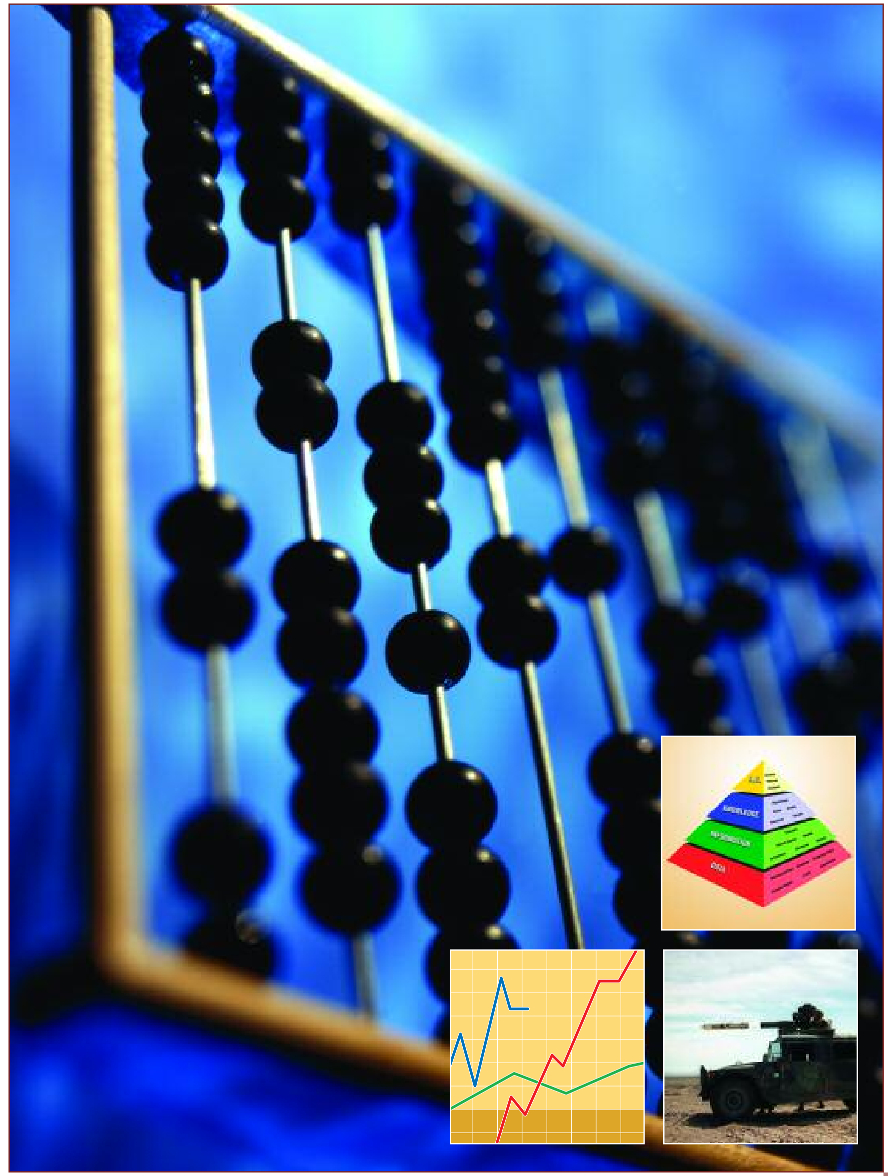
FOCUS AREAS

Biological Sciences Applications

This research involves managing and analyzing information about biological systems. For example, to develop early warning and surveillance systems for biological threat agents, we may be interested in rapidly identifying organisms and pathogens, identifying geographic soil locations and background microorganism content, or classifying ecological microclimates. Research includes large-scale epidemiological simulation, genetic data analysis, and ecological and environmental statistics.

Computational Statistics

Researchers in D-1 need computational environments to do rapid prototyping of new methods, particularly Markov chain Monte Carlo (MCMC)-based methods. We employ modern techniques from statistics, computer science, and applied mathematics in search of such environments. The complex problems we solve often involve massive data sets with characteristics (e.g., many dimensions, nonhomogeneity) that make them difficult to tackle with traditional statistical methods. These analytical methods are computationally intensive and often make use of visualization tools to help understand the structure of large data sets. Currently, we are developing an



extensible object-oriented system, named YADAS, to help perform these analyses.

Information Integration Technology

Information integration technology (IIT) is a framework of processes and methodologies used to combine and integrate information from diverse sources to produce traceable, mathematically rigorous assessments of system performance. The framework is flexible (e.g., real data, experimental data, results of computer simulations, and expert opinion can all be used) and supports a range of objectives, from estimating reliability to decision-making under uncertainty. We create qualitative representations of complex systems and then, with the help of automation tools, transform those into quantitative, statistical models to produce full distributions, with uncertainties, for performance metrics. We are using IIT in collaboration with partners from the weapons community, from industry, and from the DoD.

Monte Carlo

Current D-1 research on Monte Carlo methods is focused on the use of biasing (i.e., importance sampling) techniques to improve convergence in simulations of time-dependent physical processes, as conducted in Stochastic Simulation/ Monte Carlo Methods. Coupling this algorithm with importance sampling has been a part of the statistical physics work in which configurations of a large system are visited using MCMC. Importance sampling is useful in improving the mixing of the chain and aids in reducing variability. Examples of recent work include simulating physical processes such as the movement of pollutants, neutrons, or agents; rare event simulation; and simulating from distributions with widely separated peaks.

Reliability

Reliability analysis is the name given to investigations into system performance and availability and how they change with time or with improved materials or processes. It involves modeling systems when objective test data are scarce or nonexistent, as with one-of-a-kind questions. Determining optimal experimental design is often part of the analysis. We analyze information that may come from real-world data, expert opinion, computational models, and physical experiments and attempt to understand the relationship between system test conditions and performance. We apply reliability analysis to problems in industry, defense, and other government agencies. We use many techniques, such as hierarchical Bayes models, Poisson processes, and MCMC.

Statistical Population Bounding

The basic population bounding problem is to determine bounds that contain a desired fraction of a population. Whereas confidence limits bound the mean with a specified level of confidence and prediction limits bound individual predicted points, tolerance bounds contain a specified proportion of a population with a desired confidence. In extensions from the basic problem, we consider distributions as they age over time, multiple populations, assessment of measurement processes, and bounds on probabilities. Examples of areas where we have applied population bounding include environmental exposure, material properties, measurement and production system variation, and nondestructive measurement techniques.

Uncertainty Quantification

We support Laboratory certification efforts by developing methods to quantify uncertainty in all aspects of stockpile performance. We model and analyze both physical data and results of computer simulations. When analyzing the results of computer models, we are concerned with how far apart the actual outcome and predicted outcomes are likely to be at a specific point in light of evidence at other specified points. Methods developed and applied include Bayesian (data combining) methods, analysis of expert judgment, linear and nonlinear modeling, multivariate analysis, and analysis of variance components. We apply these methods in a variety of areas, from sampling issues that arise in core surveillance to resolution of significant findings. ■

POINT OF CONTACT

Sallie Keller-McNulty
phone: 505-667-3308
email: sallie@lanl.gov

D-2 Stockpile Complex Modeling and Analysis

The Stockpile Complex Modeling and Analysis Group, D-2, provides the Laboratory with the unique and vital ability to analyze complex problems and plan integrated solutions in support of our national security. D-2's mission is to develop modeling tools, systematic analyses, and integrated planning options through the systems engineering process to assist the Laboratory and the nation in formulating well-informed and timely decisions in transforming the Weapons Stockpile and Nuclear Weapons Complex; this mission is achieved using the group's analytical capabilities, and its technical expertise and experience.

FOCUS AREAS

Non-nuclear Facility Planning and Analysis

The Non-nuclear Facility Planning & Analysis Team has extensive experience in discrete event simulation modeling and systems engineering. Within the Laboratory, we have applied this work to the high-power detonator production facility expansion as well as to non-nuclear component production. A model of the Laboratory's high-powered detonator facility expansion guided DX Division management in setting equipment requirements and designing procedures to transition into the expanded facility. The team also completed a 3-D model visualizing the hazardous materials machining facility in the main shops. Currently, we are developing 3-D models of alternative material transport systems being considered for the Lean Agile Manufacturing Prototype System (LAMPS) machining module.

Manufacturing Capacity Analysis

Currently, the plutonium facility at Los Alamos is the only facility in the NNSA within the DOE complex that has the capability to produce WR pits for the nation's nuclear weapons stockpile. Los Alamos has developed, demonstrated, and currently maintains a viable pit-manufacturing capability, albeit at a relatively low production rate.

The Manufacturing Capacity Analysis team is focused on obtaining a reasonable pit fabrication capacity, given a suite of assumptions regarding equipment, project, infrastructure, and personnel. This study requires significant collaboration with NMT, MSM, ESA, and MST Divisions, as well as external reviews by personnel from Lawrence Livermore National Laboratory.

Stockpile-Complex Decision Analysis

D-2 is leading the Laboratory's effort to provide defendable models, data, and analyses to support the NNSA in defining the transition to the nuclear weapons

stockpile and nuclear weapons complex of the future. The future nuclear weapons stockpile will be smaller, more robust, easier to certify, easier to manufacture and maintain, more versatile, have higher surety, and lower life-cycle cost. The nuclear deterrent of the future will rely on a nuclear weapons complex that is responsive to the needs of the nuclear weapons stockpile in a rapidly changing geopolitical environment, with the ability to design, certify, and produce weapons in a much shorter time frame than has been done in the past, while being more efficient in terms of cost, waste, safety, and security. This transition will take place while providing maintenance, surveillance, and other support functions to the existing stockpile. D-2 is providing analyses through its modeling and planning efforts that enable Laboratory and NNSA management to make informed decisions.

Lean Agile Manufacturing Prototype System (LAMPS)

D-2 is leading the effort to design, develop, and build a robust machining module that will incorporate industry standard technologies and business practices, as well as eliminate the generation of mixed waste from the machining module. Technologies of interest include machining, contour inspection, welding and joining, cleaning, radiography, density measurement and nondestructive weld inspection. Equipment will be selected for use in LAMPS through a well-structured, stage-gate process using process requirements.

Manufacturing Systems Modeling & Analysis

The Manufacturing Systems Modeling & Analysis Team uses a combination of modeling, simulation, and analytical tools to perform a systematic, detailed analysis of several types of manufacturing systems including factories, recovery/refining operations, and assembly operations.

The information gleaned from the data acquisition process can be incorporated into a variety system modeling/simulation tools. The team runs the simulation to determine obvious bottlenecks and other nascent system features, and to validate the tool and data. Modification and database-refinement processes are repeated until there is the level of precision necessary to complete the systems analysis to the satisfaction of the customer.

The models provide comparisons between the different technologies for the LAMPS and the Modern Pit Facility Project, and establish data to guide technology and module development. The potential impact of a given technology can be tested in the manufacturing environment (assuming there is best estimated performance criteria) to determine the productivity, cost, or safety performance of the modeled technology. This approach determines which projects have high-impact potential and then directs the technology development resources to those projects.

Project Risk

The D-2 group's Project Risk Team developed a comprehensive systems-based project risk analysis methodology and has applied it to more than twenty major projects.

A typical risk analysis produces cumulative probability distribution functions that describe the confidence levels for achieving a desired result for a given project. Performance measures and rankings of the project performance are used to measure sensitivities to various perturbations or inputs. D-2's analyses identify the most important contributors to risk, and hence, the most promising candidates for mitigation actions. Quantitative project risk analysis results can also be used to provide a rational basis for setting baseline schedules and cost targets and for establishing appropriate contingencies for projects.

In addition to traditional risk analyses of defined projects and programs, the Project Risk Team is increasingly being asked to assist in early program/project definition and decision-making. This type of systems engineering level work is a natural adjunct to our more traditional risk analysis work and involves many of the same methods and tools, but it often requires more rapid response and thus yields less quantitative results.

Risk analysis results are currently being applied to the following projects: TA-18 Relocation, CMR Replacement Project, W76-1 Life Extension Project, Significant Finding Investigation Projects, B61-Alt 357, HR cost analysis for new hires, Red Network Project, DAHRT Mitigation Project, DAHRT Second Axis, and Weapon System Qualification Tests (subcritical experiments, hydro, small/medium/large scale experiments).

The Project Risk Team is also assisting the Lab's Enterprise Project (EP) Strategic Planning Team with a risk-based prioritization of alternative path forward strategies for EP implementation.

Megaports Program

The N Division Second-Line-Of-Defense Program uses devices designed to detect small amounts of SNM at seaports, ports of entry, and airports. The Megaports Program is a spin-off that targets major transshipment sea ports. D-2 personnel support this program by providing expertise in locating and operating of the Megaports instrumentation.

The objective is to detect any SNM-bound for an American port, providing homeland defense officials with time to interdict any such shipments before they dock. ■

POINT OF CONTACT

Tom Farish
phone: (505) 665-5170
email: tjf@lanl.gov

D-3 Systems Engineering and Integration

The Systems Engineering and Integration Group, D-3, uses an interdisciplinary approach to complex systems analysis in the following programmatic areas: chemical and biological defense and countermeasures; nuclear weapons systems; and nuclear energy systems, primarily in the area of advanced fuel cycle technologies. We develop the models, simulations, and other requisite analytic tools necessary to capture the complex relationships and system-of-systems interdependencies of the problems presented to us.
This end-to-end, system-of-systems approach and operational perspective distinguishes our work and creates the unique niche for a demanding customer set that includes the DoD and DHS operational communities.

Core competencies of D-3 include nuclear weapon effects, software system design and development, systems analysis, systems integration, distributed computation, strategic studies, and fusion systems and fuel cycles.

FOCUS AREAS

Systems Analysis and Integration for Homeland Defense

D-3 supports the DHS, DTRA, NNSA, and Environmental Protection Agency (EPA) by providing systems analyses in the areas of chemical and biological countermeasures (BioWatch, BioNet, the Water Security Demonstration Project, and associated programs) and radiological countermeasures. D-3 also provides systems integration expertise for multilayer systems-of-systems for homeland security including the BASIS, BioWatch, and Unconventional Nuclear Warfare Defense (UNWD) projects. In 2004, the BASIS team supported three high-profile deployments at national security special events. The system was deployed at the G-8 Summit at Sea Island, Georgia; the Democratic National Convention in Boston; and the Republican National Convention in New York City.

Systems Analysis, Engineering, and Code Development for Nuclear Weapons Applications

D-3 supports NNSA and the DTRA by providing systems analyses and engineering for stockpile stewardship and advanced concepts weapons systems such as the Advanced Concepts Technology Development (ACTD) and Tunnel Target Defeat (TTD).

Systems Analysis and Modeling for Chemical/ Biological Detection

D-3 supports the DHS, DARPA, DTRA, and EPA by providing tools and support for dealing with airborne chemical,

biological, and/or radiological releases. These tools include a building-aware fast response urban dispersion model (QUIC), bio collector siting models (BioWatch Sensor Siting & QUIC Sensor Siting), an event reconstruction model (BioWatch ER), and urban databases.

Systems Analysis and Code Development for Nuclear Fuel Cycle Applications

D-3 provides systems analyses and simulation code development in support of the Advanced Fuel Cycle program and the fundamental science of transmutation of nuclear waste.

Nuclear Weapons Studies Requirements and Analysis

Under the broad category of nuclear weapons studies, institutional analyses are performed to support the formulation of several Laboratory positions including stockpile planning, advanced concepts analysis, and weapons requirements. Weapons studies have addressed a broad range of nuclear weapons concerns ranging from estimating stockpile size in a START III environment and tritium requirements over the next 20 years, to plutonium-pit production in the twenty-first century and integrated security and use control risk assessments, to weapons effects analysis and lectures on the history of the weapons programs for the Laboratory's Theoretical Institute of Thermonuclear and Nuclear Studies (TITANS).

Maintaining a broad-based nuclear weapons analysis capability is critical to identifying the pressing issues and making recommendations to the decision makers who are guiding the weapons programs. Current projects utilizing this capability are the robust nuclear Earth penetrator (RNEP) advanced concepts feasibility study, reliability replacement warhead planning, Earth penetrator weapons effectiveness tools development, and long-term nuclear weapons strategy and technology studies. ■

POINT OF CONTACT

Kristin Omberg
phone: (505) 667-9628
email: komberg@lanl.gov

D-4 Energy and Infrastructure Analysis

The Energy and Infrastructure Analysis Group (D-4) performs basic and applied research to secure the nation's energy infrastructure. Central to this research is the development of computer models of energy industries and other infrastructures. Group members work closely with physicists, engineers, mathematicians, statisticians, computer scientists, and economists to develop large-scale, detailed models of energy industries and infrastructures. Our macromodels and microsimulations quantify the physical, operational, and economic behavior of energy networks including the generation, transmission, and distribution of electric power, natural gas, oil, and coal, as well as nonenergy infrastructures important to energy security. Often these models are combined within interdependency, optimization, and risk assessment frameworks.

Our current research activities include developing and testing new technologies for the next generation of electrical grids. These new technologies must be integrated into a complete infrastructure architecture that includes hardware solutions as well as modeling, simulation, and data analysis. The new programs supporting the next-generation electrical grid must sense the health of the grid and input this data into the models. D-4 also participates through a steering group that includes Sandia and Argonne National Laboratories. The first EITAC visualization capabilities were Los Alamos products.

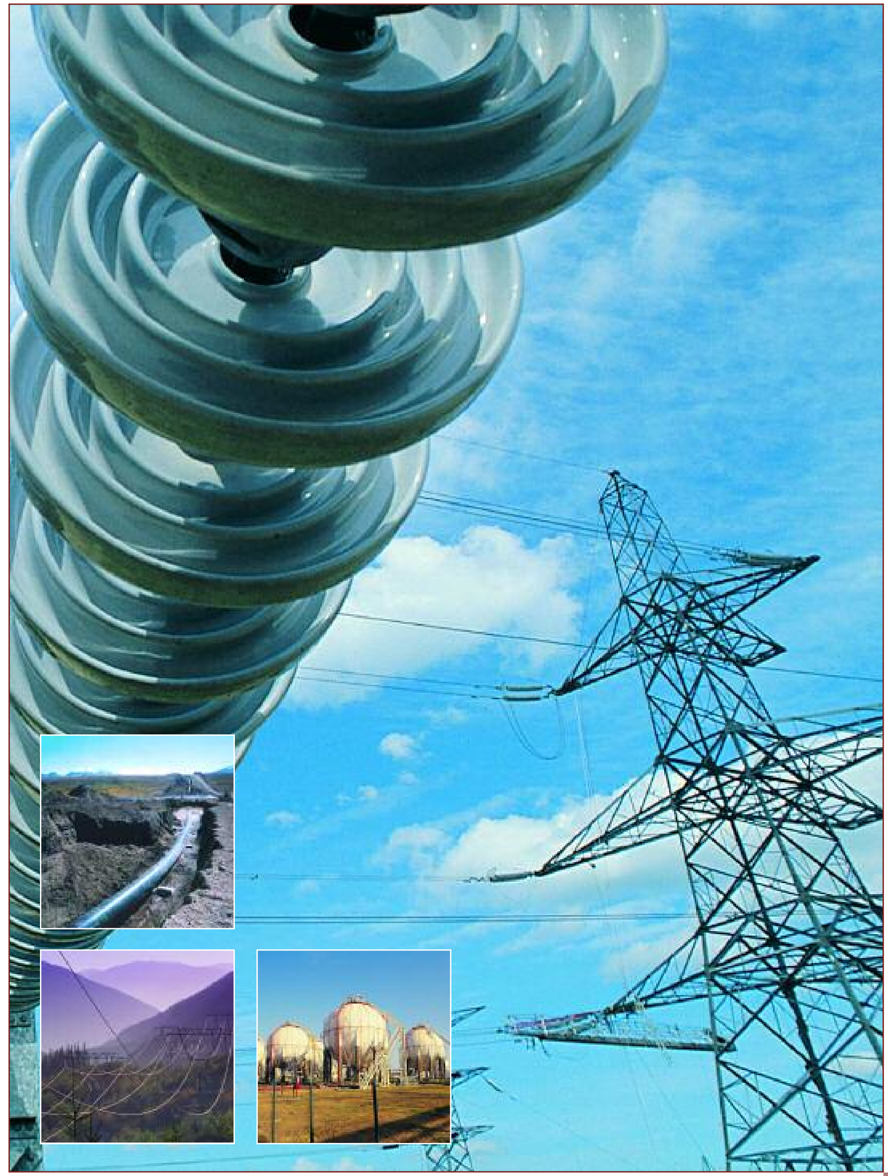
The core competencies of D-4 include infrastructure modeling, simulation, and analyses; economic and financial analyses; and environmental, energy systems, and transportation systems analyses.

FOCUS AREAS

Economics Team

The D-4 Economics Team provides economic expertise in two primary areas: economics for institutional analysis and models for inclusion in simulations. The institutional analysis provides information to Laboratory management on the economic aspects of proposed actions. Economic considerations underlie a significant number of the decisions made in areas such as energy, transportation, and communications. To adequately simulate the characteristics of these sectors, we must include economic considerations in the simulation.

Institutional analysis at Los Alamos encompasses an eclectic collection of projects and analysis techniques. Economists use general equilibrium models, regression statistics, data mining, and linear programming, among other methods, to complete commissioned analyses. Project areas include macroeconomic modeling, monetary and financial flows analysis, natural resource and



energy economics, environmental analysis, and engineering economics.

The economics team continues to provide economic analysis for the facility upgrades and the restructuring described in the Lab's new facilities plan.

Data Management and Information Systems

The Data Management and Information Systems Team provides the national infrastructure and network data used in the NISAC simulations and for DoD, DHS, and DOE programs outside the Laboratory. Network data from this program provided the real transportation data for TRANSIMS, created the needed data source for Clean Coal Technologies Demonstration Program, and provides the source data for the Division's many types of simulations and analyses.

The transportation simulator TRANSIMS uses data to define various road networks. Planners then use this information to evaluate transportation scenarios, including emergency evacuation plans, for cities. Using TRANSIMS we developed road network models for Dallas/Ft. Worth, Portland, Houston, and Chicago. Research is underway on methods to streamline the TRANSIMS process to improve the generation of road networks.

The Clean Coal Technology Demonstration Program is a unique partnership between the DOE and industry. Its primary goal is to successfully demonstrate a new generation of advanced coal-based technologies, with the most promising technologies moving into the domestic and international marketplace. The demonstrations are at a scale large enough to generate the data users need to make judgments about the commercial viability of a particular process. These demonstrations will improve the global environment and energy security through the use of technologies and services provided by U.S. industry.

Visualization Team

The D-4 Visualization Team is experienced in many areas of scientific, geographic, statistical, and information visualization. Using commercial tools such as geographical information systems (GIS), mathematical analysis tools, simulation systems with graphical or visual front ends, and also custom-developed software, the team helps analysts, simulation scientists, and planners understand, share, and present their data more effectively.

The team also operates the D Division Visualization Laboratory, which offers high-performance graphics processors; a range of visualization and graphics tools; a large-screen, stereo-enabled projection environment; quadraphonic sound; and some motion tracking for virtual reality applications.

The Visualization Team collaborates with other laboratories, industry, and academia to research advanced perceptualization, which includes a sense of "presence" or "immersion " and the use of richer cognitive models, beyond merely geometric or psychometric, in a readily understandable format.

Network Analysis Team

The D-4 Network Analysis Team handles analytics tasks related to characterizing network performance, including a diverse set of infrastructures such as electric, gas, pipeline, telecommunications, and transportation networks. Analyses focus primarily on normal or off-normal conditions arising within each regional or local network. Site-specific analysis can also include service and outage area estimates, as well as estimates of outage duration based upon component criticality considerations.

Appropriate interpretations of system-level metrics that result in degradations to commercial delivery capability and to varying system considerations throughout a typical year are reviewed. Network analysis often includes three components: regional system, local operational, and on-site. The analyses use both quantitative and qualitative processes. Electric networks are analyzed to identify transmission/subtransmission lines that are critical for power transfer and subtransmission system configuration. The analysis can be extended to other considerations, including the availability of generation units for local system demand and voltage stability.

Results from our network analysis efforts assist decision makers in the areas of policy analysis, investment and mitigation planning, education and training planning, vulnerability and criticality assessments, consequence management, and real-time crisis assistance.

Software Systems Team

The Software Systems Team, along with the Mathematical Modeling Team, is developing the Interdependent Energy Infrastructure Simulation System (IEISS). IEISS simulates the physical and operational behavior of interdependent energy infrastructures during incidents and disruptions. It can identify and rank critical components across energy infrastructures, estimate outages, and quantify feedback.

The tool's primary advantage is its ability to model the interdependencies between energy networks and to identify how a system's particular physical components behave during disturbances and contribute to their severity. It also assesses the potential for feedback between energy transmission systems (cascading failures). Using the tool, we can examine thousands of possible scenarios quickly in order to pinpoint what caused the most severe impacts. We can also determine the geographic extent of service outages, including which customers are affected. ■

POINT OF CONTACT:

Steve Fernandez
phone: (505) 667-2124
email: sjf@lanl.gov

D-5 Nuclear Design and Risk Analysis

The Nuclear Design and Risk Analysis Group (D-5), is a multidisciplinary team of scientists and engineers. We provide modeling and analysis capabilities to design and evaluate the potential risks of complex systems, with a focus on nuclear systems. D-5 goes beyond just providing an answer: we provide answers in context of the overall decision process. We ensure that decision makers have all available knowledge to make an informed regulatory, design, or risk decision.

D-5 is a leader in reactor design for government applications, including space nuclear power. We are also a leader in the analysis of risk of nuclear facilities, nuclear reactors, and nuclear weapons. D-5 employs a wide range of tools, including state-of-the-art radiation transport models, complex three-dimensional thermal-hydraulic models, combined experimental and modeling capabilities, and state-of-the-art logic modeling tools that encompass linguistic and numeric data. D-5 can provide answers to a broad range of questions involving nuclear systems.

D-5's core competencies include design and analysis of nuclear reactors, thermal hydraulics, and computational fluid mechanics; application of radiation transport codes (MCNPX); probabilistic risk and safety assessments; probabilistic system and vulnerability modeling; facility safety analysis report development; nuclear weapons studies; explosive safety, logic-evolved decision trees, and decision analysis; and custom software and engineering tool development.

FOCUS AREAS

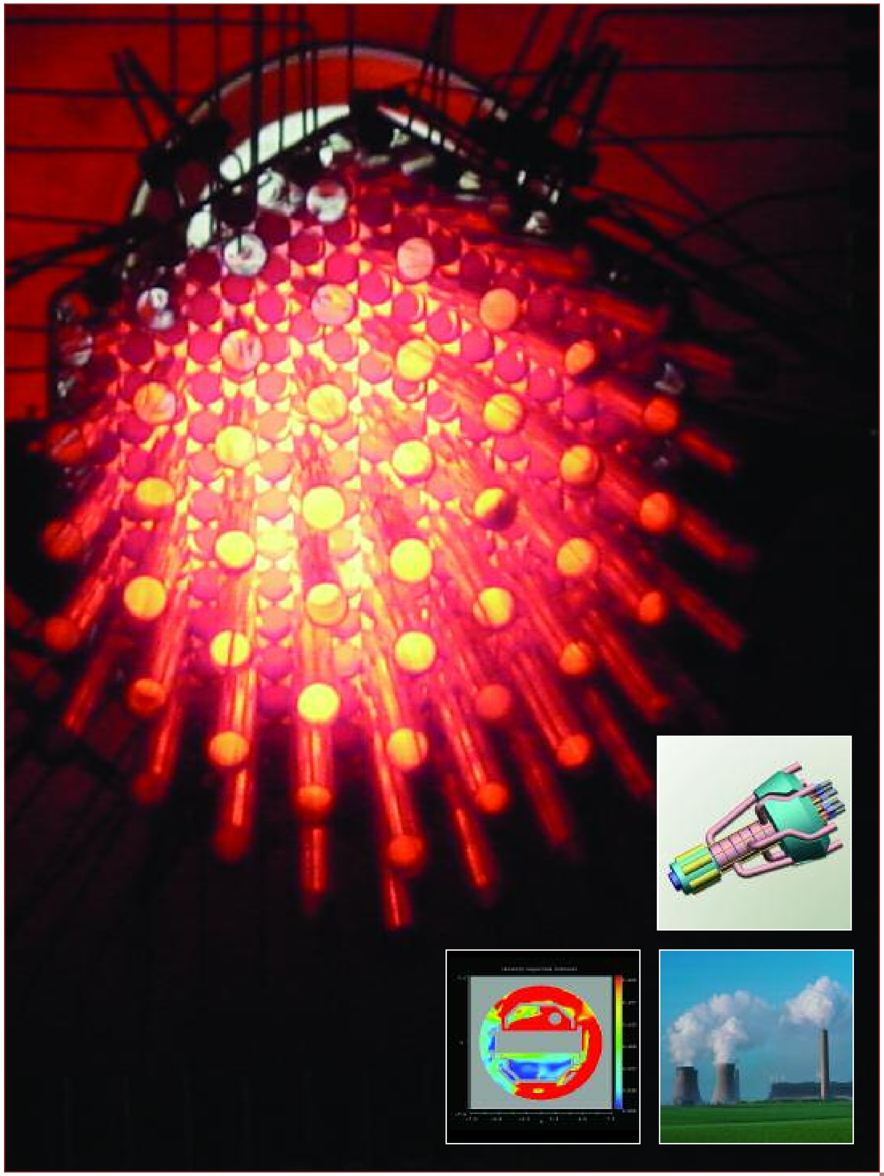
Nuclear Safety & Regulatory Analyses

D-5 supports several NRC-directed research activities in the areas of safety performance and regulatory issues affecting the design and operation of nuclear power plants. Recent studies include a reliability assessment of an Emergency Core Cooling System (ECCS) during a loss of coolant accident (LOCA) and a risk-informed regulation study to quantify the risk significance of nuclear power plant licensing amendments to improve operation and/or cut unnecessary costs.

D-5 is working in conjunction with the University of New Mexico on an experimental program to examine the long-term (30 days) chemical processes occurring in post-LOCA containment environment.

D-5 is also active in providing 10 CFR 830-based safety analysis for the Laboratory and other NNSA-regulated nuclear facilities. Facilities and projects that D-5 is active involved with include

- TA-55 Safety Analysis Report
- New CMR building design



- TA-18 Critical Assemblies Facility Safety Analysis
- TA-18 early move of SNM
- Device Assembly Facility (DAF) critical assemblies facility design

Code Development

D-5 developed and maintains the Transient Reactor Analysis Code (TRAC). This powerful system-level analytical tool has multiple applications to complex systems, including nuclear power plants, experimental facilities, and space reactors. TRAC also is a best-estimate tool to predict complex system response to off-normal events. D-5 is also assisting the NRC as it begins the licensing activities associated with new reactor designs and other advanced systems.

Risk-Based Decision Support

D-5's core capabilities include qualitative and quantitative economic analysis, risk analysis, and decision support for a wide crosssection of Laboratory projects and programs. Recent and ongoing activities of this type include

- planning and analysis support for the Laboratory's enterprise business systems development project
- extensive systems analysis and management systems support for the Laboratory's COMPASS (resumption) project.
- Lab G&A budget prioritization
- Welch salary analysis
- contingent workforce analysis
- worker replacement cost analysis
- Tri-Lab security technology initiative

One of D-5's most significant growth areas is the application of logic-evolved decision trees to vulnerability assessment and information loss. This methodology continues to find increased acceptance in the security community. The growth in the area of probabilistic system and vulnerability modeling is driven mostly by the events of September 11, 2001.

Small Reactors

D-5 has a dedicated team of engineers focused on the development of space fission reactors. This team has developed several innovative reactor concepts, including a compact, robust, and highly safe reactor that is cooled by heat pipes. Several prototype units of the heat pipe-cooled reactor have been built and tested successfully by D-5 and the NASA. NASA intends to use this reactor to enable ambitious, electrical power-rich exploration anywhere in our solar system.

Weapons Safety

D-5's work in the area of stockpile stewardship supports the Laboratory's mission to reduce the danger of nuclear mishaps. Our expertise in this area is focused on designing safety into nuclear weapons production and maintenance processes, conducting nuclear explosive risk and damage assessments, and evaluating the safety of testing programs related to nuclear weapons. In addition, we have developed custom software to be used in these assessments.

POINT OF CONTACT

Patrick McClure
phone: (505) 667-9534
email: pmcclure@lanl.gov

D-DoD Department of Defense Program Office

The Department of Defense Programs Office (D-DoD) is part of the D Division organization and is responsible for the planning and Laboratory-wide integration of DoD non-nuclear weapons defense programs. The office strives to enhance the DoD programs portfolio through effective communications and interactions with DoD sponsors, opportunity assessments, program development, integrating Laboratory-wide efforts, contributing to strategic planning, aiding with Los Alamos proposal development, and supervising DoD programs execution.

The DoD Program Office goal is to support the Laboratory, the Threat Reduction Directorate, and D Division strategic plans and to apply the Laboratory's expertise to the broad spectrum of military technological needs.

FOCUS AREAS

Conventional Weapons Technologies

The conventional weapons technologies area exploits and enhances the core strengths of the Laboratory in conventional munitions, high explosives and energetic materials, advanced warheads, and lethality and survivability. The Laboratory is developing new energetic materials that perform as well as today's best materials, but have improved properties, including safety. As part of this work, Laboratory researchers are developing new models to predict quantitatively how explosives will behave in abnormal environments such as accidents or fires. The Lab continues to work on initiation systems based on exploding foil technologies to provide design flexibility, enhance weapons safety, and lower production costs. The Laboratory is also implementing major improvements in computer codes to simulate the behavior of weapons systems and subsystems. Researchers are investigating new, physics-based computations of material behavior to significantly improve our ability to predict explosives effects.

Defense Advanced Concepts

Defense advanced concepts programs are often relatively small efforts to develop or understand technologies and to focus them on specialized DoD applications. Optimally, a successful concept grows into a major program. Presently, Los Alamos is developing high-power microwave technology with several potential applications. Lab scientists are also working on biomimetic computing and understanding eye-brain function These projects should lead to advanced detection systems that emulate how humans "see." The Lab is also working on concepts for detecting and even defeating enemy underground facilities.

Defense Sensor Technologies

Defense sensor technologies work is focused on developing sensors for treaty verification, space-based surveillance, satellite protection, and the battlefield. Los Alamos is supporting the Air Force in detecting nuclear explosions, primarily using detectors (W-sensors) integrated into Air Force satellites orbiting Earth. This support includes developing and maintaining specialized software and models for assessing radio sensor performance and radio signal propagation through Earth's ionosphere, on-orbit sensor testing, and systems and data analysis. These, and other, sensors are also used to study "space weather," allowing us to understand satellite performance and reliability. Los Alamos has also developed an ultrasonic device to nonintrusively detect chemicals in various containers such as artillery shells and 55-gallon drums for treaty verification and counterproliferation programs.

High-Performance Computing

The Laboratory's high-performance computing initiatives are developing a computing environment that enables the solution of large-scale, complex problems for both defense and dual-use applications. Los Alamos is working with IBM on a project to develop a new generation of high-performance computing. There is also a large effort to develop and use reconfigurable computers for intelligent sensors as well as for large "main-frame" computation.

Modeling, Simulation, and Analysis Applications

DoD synthetic environments are virtual representations of the physical and behavioral phenomena of complex military systems that are achieved through mathematical modeling and simulation. These environments are used for training (eliminating the costs of thousands of troops, planes, and ships in the field) and for testing novel war fighting strategies and tactics against new threats or using new weapons and information. Los Alamos is working on tools for this training and analysis regime. There is also a need to simulate complex infrastructures, such as the entire power grid, to determine vulnerabilities or even efficient points of attack that could shut down enemy command and control. We have several projects in the area of understanding infrastructures. Additionally, using complex agent-based and statistical models, we can understand and predict some human behavior. Based on these concepts, Los Alamos developed a model and simulation of terrorist networks and how they might respond to different stresses.

Directed Energy

There are numerous needs within the DoD for directed-energy systems, ranging from man-portable to large missile systems. Los Alamos is currently working with the U.S. Navy on free-electron laser technology, for potential installation on warships. This technology has the potential to rapidly destroy attacking missiles. We are also working on concepts for making high-powered, directed microwave systems much smaller and more useful.

System Performance and Reliability

Major weapons systems often cannot be tested or even designed without extreme costs or potential of destruction. Los Alamos is designing statistical tools to allow prediction of the overall system behavior using data from limited subsystem testing and from computational models. These statistical tools allow designers to understand failure points and then focus design efforts on these points, which allows repair or replacement of parts when they actually become worn rather than on a maintenance schedule. This approach vastly improves reliability as well as cutting costs.

Chemical, Nuclear, and Radiological Defense

Advanced technologies that provide defenses and responses to WMDs are a major focus area for DoD programs. Traditionally, the quartet of chemical-biological-nuclear-radiological threats defines WMDs. The chemical-nuclear-radiological systems characteristically have close technical ties to nuclear weapons and conventional munitions activities and are part of the DoD programs. The biological section of the Center for Homeland Security handles biological threats. DoD has programs to detect hidden nuclear devices and to understand the systems and requirements to emplace position detectors for maximum efficiency. We are also starting a major program to develop technology and operational methods to decontaminate affected areas after a radiological attack.

Missile Defense

The DoD has identified missile defense as a major element in the ongoing force transition ordered in response to changes in the international threat since the end of the Cold War. These changes predicate a need for a more dispersed and faster responding defense net. Our DoD missile defense projects are providing the research and development for advanced missile defense systems that will meet the challenging performance requirements inherent in responding to increased global threats.

Military Space Applications

Los Alamos' experience in developing and building small satellites and instruments for satellites puts us in position to aid in many military problems in space. Current research includes developing sensors and data analysis to give real-time, battle theater information and systems to measure and understand threats to the United States' complex, existing satellite network.

POINT OF CONTACT

Dan Prono
phone: (505) 667-1775
email: dprono@lanl.gov

Decision Applications Division

Research Summaries

Statistical Design of Experiments

Statistical Design of Experiments provides techniques for efficient allocation of resources to different sets of experimental conditions. In the discrete case, as the number of variables and the number of possible levels of a variable increase, the set of all possible experiments can become very large. In the continuous case, there may be infinite possible combinations of input values. Using statistical methods for design of experiments, sets of input values are selected from the set of all possible runs to obtain desired information.

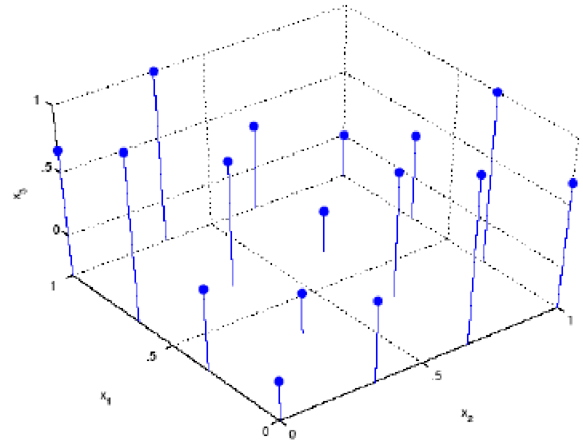
These methods may be used for either physical experiments or computational experiments using computer models. In physical experiments, repeated measurements will yield varying values resulting from random variation in the sample units and the measurement process. Often, physical restrictions inherent in the data collection process impact the choice of an appropriate design. In computer experiments, codes may be either deterministic, resulting in a unique value for any given set of inputs; or stochastic, with variability in the outputs arising from a random process designed into the computer code.

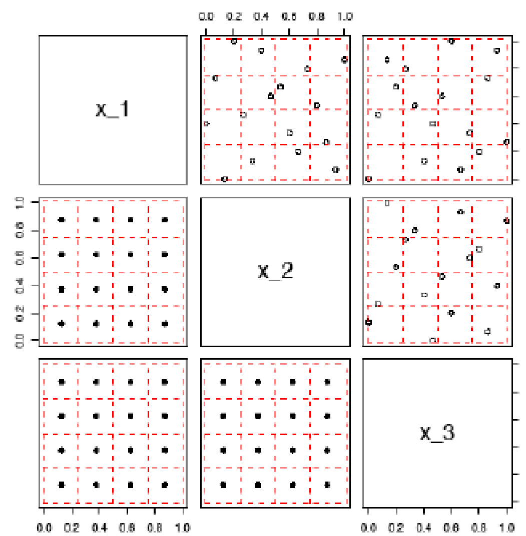
Physical experiments have been designed for plutonium metallurgy experiments, for material compatibility experiments, and for experiments to evaluate alternative formulations of replacement materials. Computer experiments have been used to evaluate output from weapon physics codes, to quantify weapons component and system reliability, to investigate airborne dispersals, and to examine alternative manufacturing configurations.

Although many standard experimental plans are available, innovative design modifications and development of new design approaches are often required for specific applications. Development of criteria for comparing alternative designs is another area of active research. D-1’s expertise in experimental design includes individuals working on a diverse set of statistical methods and applications. ■

POINT OF CONTACT

Joanne Wendelberger, D-1
phone: (505) 665-4840
email: joanne@lanl.gov





An example of OA-based LH design.

Knowledge Discovery

To better protect Americans at home and abroad, there is an ever-increasing need to find actionable intelligence from multiple data sources. Specifically, we need to integrate data from a large number of diverse sources and deliver it to the people who need it in a timely fashion. D-1's Knowledge Discovery projects are developing the methods and tools to support this need.

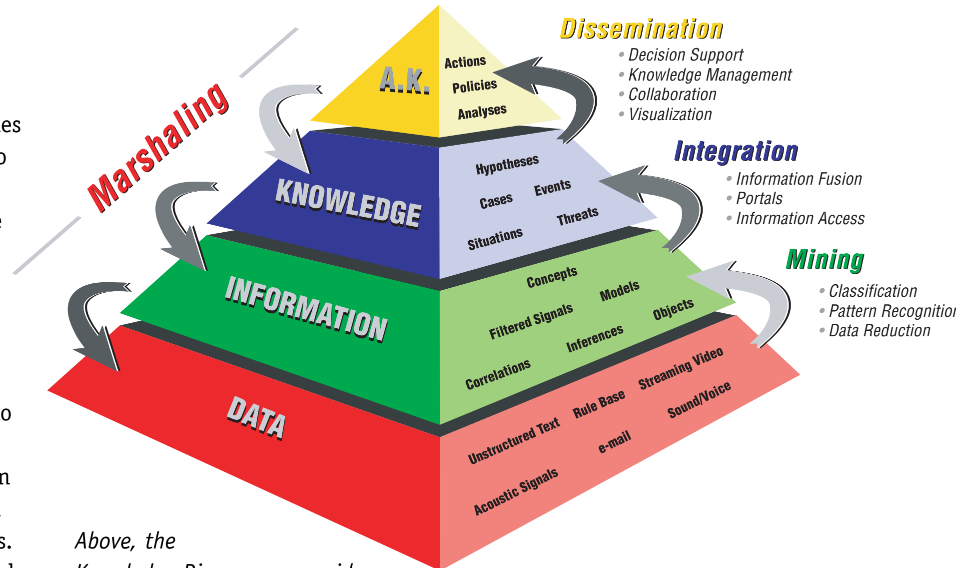
In cooperation with defense, intelligence, and homeland security sponsors, we are developing software systems to span the full Knowledge Discovery Pyramid. The bottom of this pyramid represents the vast amounts data that must be mined and modeled for patterns, trends, etc. The center of the pyramid shows the integration of results from multiple diverse data sources, leading to formulation of quantified threat hypotheses and situations. The top of the pyramid represents the dissemination of actionable intelligence to users in a collaborative manner. On the left-hand side of the pyramid, from top to bottom, evidence marshaling defines methods for gathering the data and information most relevant to further understanding of the threats at hand.

The methods we are developing are probabilistic in nature as represented by the Bayesian network figure. These networks integrate diverse types of evidence into quantified threats such as the existence and type of weapons of mass destruction and their location. Evidence marshaling supports subsequent tasking of assets such as airplanes or satellites to gather more evidence to further refine threat quantification estimates. Optimization techniques are employed in marshaling to support usage of assets in a more effective manner than is typically done today.

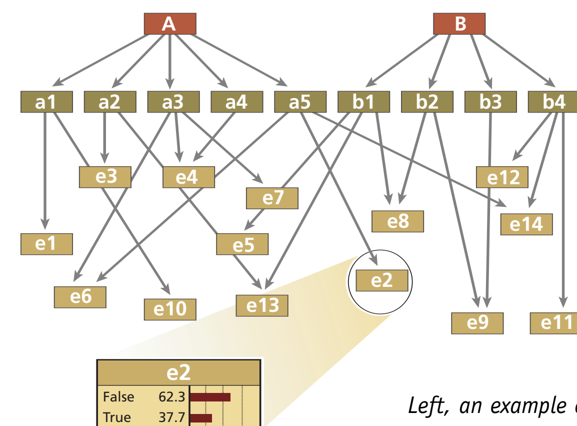
With the methods and tools we are developing, we are able to provide a greater level of situational awareness to decision makers, thus enabling better resource management of data collection and providing the ability to share data and information across decision makers. This success has been borne out through delivery of demonstration systems for the defense and intelligence agencies. ■

POINT OF CONTACT

Deborah Leishman, D-1
phone: (505) 667-2796
email: leishman@lanl.gov



Above, the Knowledge Discovery pyramid.



Left, an example of a probabilistic Bayesian Network used for integration of diverse data.

System Modeling for Statistical Analysis

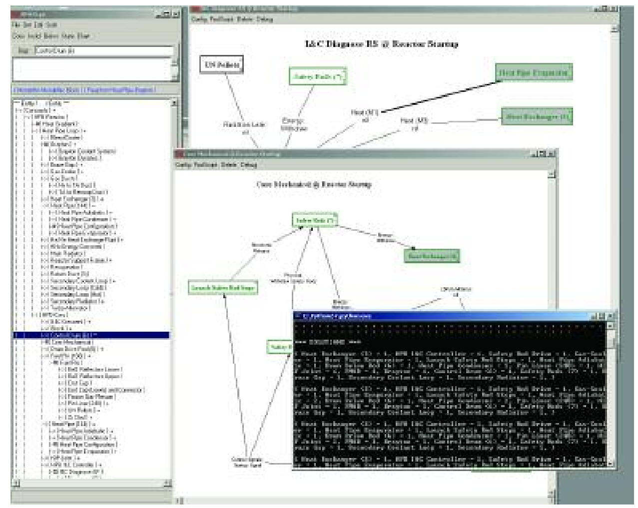
Over the past several decades, the ability to build and deploy systems exhibiting behavioral and dynamic complexity has greatly increased. This increase in engineering and operational complexity has outstripped the ability of those involved with system reliability and design confidence methods to ensure that models describing the statistical performance are verifiably traceable to engineering system descriptions, integrate all available data (both quantitative and qualitative), and describe dynamics accurately.

The Graphic Representation Ontology Modeling Inference Tool (GROMIT) is part of a broad research effort by the Statistical Sciences (D-1) group to improve complex systems modeling and analysis for a broad set of “forensics” purposes. This software tool is designed to provide users with three main capabilities:

1. System Logic Description: GROMIT provides tools to describe the entities and dynamic relationships that make up a system. It supports graphical modeling of the system and also maintains an underlying formal representation that allows the user to keep track of entities and relationships and ensure they are logically consistent throughout the model. These representations are called “logic networks.” Logic networks support systems ethnography in the broadest sense, by enabling the analyst to capture and reconcile the different hypotheses that he or she collects about the system. These hypotheses may be quantitative or qualitative in nature. This last point is particularly important—as system design efforts become scattered between different teams, statistical modeling often requires an understanding of subsystem relationships different from that needed for system engineering or integration efforts.

2. System Dependency Behavior Modeling: GROMIT enables the user to specify a set of possible states for each entity or channel (relationship) in the model and to specify rules for how those states change in response to inputs from other entities or channels. The user can observe how the effects of a change at one point propagate throughout the collection of logic networks associated with the system. The user can also describe various system activity modes in terms of the states of individual entities and channels. These functions can support the development of statistical models.

3. System Inference Structure Derivation: Based on the system description and behavioral rules, GROMIT can calculate all the possible combinations of failures that could lead to a particular observed system outcome. In essence, a GROMIT model serves as a database describing a huge set of



“query-able” failure effect analysis models. Users can experiment with how adding additional data collection points changes the number of possible “cut-sets” relating to a wide set of dynamic fault-tree-like structures. This capability is useful for system forensics as well as for supporting statistical analysis of failure scenarios. GROMIT (when completed) will then semi-automatically pass these cut-sets into the D-1-developed inference package YADAS.

GROMIT provides the capabilities described above through a multilayer system representation interface. This layered interface means that novice users or those who are interested only in qualitative description can start building models quickly, while higher-level logical and inference capabilities can be accessed as increased system information becomes available. This feature also makes GROMIT suited for serial development of reliability models along with the system design process. ■

POINTS OF CONTACT

Richard Klamann, D-1
phone: (505) 665-6709
email: rmk@lanl.gov

Andrew Koehler, D-1
phone: (505) 667-9513
email: akoehler@lanl.gov

Genetic Data Analysis

D-1's genetic data analysis research involves managing and analyzing information from biological systems. Our work with amplified fragment length polymorphisms (AFLP) is an example. AFLP produce an inventory of fragments that are repeatable because of DNA cutters that work at specific sites. This inventory generates a fragment distribution that, in turn, yields a "fingerprint" specific to each organism.

In collaboration with scientists from B Division, we create models of the data and perform statistical/computation base analyses of AFLP data. The analysis allows us to classify and identify biological organisms of interest, including organisms that are biological weapons or, more importantly, are similar to biological weapons. For example, a recently analyzed deadly human pathogen had the virulence genes from *Bacillus anthracis* (the bacterium that causes anthrax), but was classified as a *Bacillus cereus* instead of a *Bacillus anthracis*. The AFLP analysis showed this sample to be similar to other *Bacillus anthracis* strains, but not identical. Other specific tests for *Bacillus anthracis* were negative. The AFLP analysis, which is a more general test that looks at more of a microorganism's genome, has been shown to be more adept at classifying these sorts of "near neighbors" than other more specific tests.

Other issues we are addressing include the use of replicates in analyses. Replicates are traditionally not used in genome fragment studies, but we were able to computerize the analysis and greatly reduce the reliance on a human expert. Replicates allow us to better address the incorporation of uncertainty into the results and data integration (the combination of information from controlled experiments with other observational data or expert opinion).

Applications of genome fragment analyses, of which AFLP analysis is one type, include rapid identification of organisms and pathogens, identification of geographical soil locations, classification of ecological microclimates, development of "background" soil and air microorganism content, and early warning systems and surveillance for biological threat agents. ■

POINT OF CONTACT

Larry Ticknor, D-1
phone: (505) 667-6055
email: lot@lanl.gov

Lean Agile Manufacturing Prototype System (LAMPS)

While Los Alamos National Laboratory demonstrated the capability to fabricate a WR-quality pit in 2004, much work needs to be done to develop a robust manufacturing system. The current technology baseline used at LANL to fabricate pits requires using obsolete equipment, relies on outdated business practices, and generates mixed waste. Using obsolete equipment leads to many potential single-point failures in the manufacturing flow sheet. Outdated business practices produce an inefficient manufacturing process by requiring operators to spend time on ancillary activities, not production operations. Lastly, generating mixed waste requires LANL to undergo a costly and time-consuming permitting process.

D-2 is leading the effort to design, develop, and build a robust machining module. The Lean Agile Manufacturing Prototype System (LAMPS) will incorporate industry standard technologies and business practices, as well as eliminate the generation of mixed waste from the machining module. Technologies of interest include machining, contour inspection, welding and joining, cleaning, radiography, density measurement, and nondestructive weld inspection. Equipment will be selected for use in LAMPS through a well-structured stage-gate process using process requirements. These requirements will include:

- Ability to meet customer specifications for plutonium parts in a glove box environment;
- Using industry standard technologies or off-the-shelf equipment with minimal modifications;
- Anticipated future vendor support;
- Lifecycle cost from installation, through maintenance, ending with disposal;
- Ability to incorporate multiple processes in one work center. e.g. placing cleaning equipment in the machining glove box;
- Minimizing rejected parts as well as minimizing plutonium that must be recycled or repurified; and
- Eliminate generation of mixed waste.

Discussions with operating personnel, as well as data generated by D-2's modeling efforts, show that a large amount of time is spent on ancillary activities. As part of a modern machining module, D-2 staff will select and demonstrate real time tracking of special nuclear material (SNM) (e.g., using RF tags and gamma detectors) and paperless data collection in a transport system using multiple carts. Also, as part of the established business practices, D-2 staff will develop a methodology for replacing obsolete technologies and/or equipment.

At the successful conclusion of this project, the result will be a robust machining module that will be able to fabricate WR pits for the foreseeable future. ■

POINT OF CONTACT

Michael Palmer, D-2
phone (505) 665-3038
email: mjpalmer@lanl.gov

Manufacturing Capacity Analysis

Currently, Los Alamos is the only facility within the DOE complex that is capable of producing WR pits for the nation's nuclear weapons stockpile. Through the Pit Manufacturing Project, Los Alamos developed, demonstrated, and maintains a viable pit-manufacturing capability, albeit at a relatively low production rate. Los Alamos' efforts on the pit-manufacturing project have re-established our nation's ability to produce pits to quality specifications.

Now that Los Alamos can manufacture WR-quality pits, the next step is to develop a robust, reliable, and proven manufacturing capability that can be easily staged into a full-scale operation. The original pit manufacturing flow sheet was based on the processes supported at the Rocky Flats Plants in the late 1980s, and it employed obsolete equipment with several single-point-failure modes. The Pit Manufacturing Project is in the process of mitigating single-point vulnerabilities in the FY2005–07 timeframe and, in so doing, will demonstrate a more robust, although still limited, pit-manufacturing mission.

Although the Laboratory has performed a number of studies to determine LANL's capacity for producing WR pits, these studies have generally focused on different components of the pit fabrication process or on pit fabrication requirements and were usually performed to obtain equipment requirements. Until now, no study has attempted to systematically integrate the quantitative process data with the more qualitative data regarding the operating constraints, such as other personnel duties, process storage constraints, etc., to obtain an overall reasonable pit capacity.

This study's major contribution is to include the above-mentioned constraints in the analysis, improving the accuracy of the capacity estimates relative to the actual fabrication capacity that is reasonably achievable instead of focusing on the theoretical capacity that could possibly be attained, given a suite of fabrication equipment. Additionally, the study incorporates a suite of assumptions including what equipment is in place as a function of time, what projects are implemented to support the manufacturing infrastructure, and what personnel are available.

We anticipate that this model, validated to current facility constraints, will be used to project pit-manufacturing rates, as well as to identify production and logistics-based bottlenecks that the project should address. This study requires significant collaboration with NMT, MSM, ESA, and MST Divisions, as well as external reviews by personnel from Lawrence Livermore National Laboratory. ■

POINTS OF CONTACT

Tom Rising, D-2
phone: (505) 665-8844
email: rising@lanl.gov

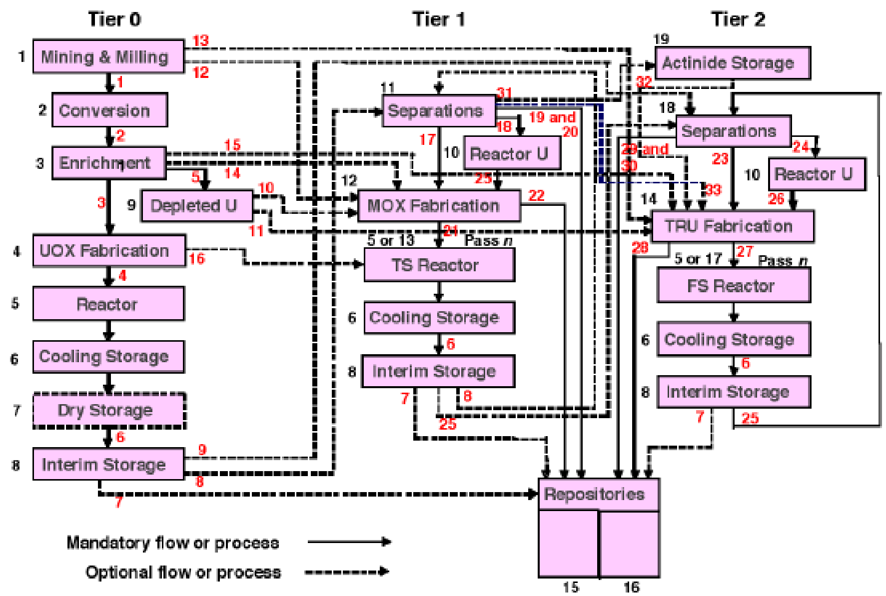
Drew Kornreich, D-2
phone: (505) 667-2095
email: drewek@lanl.gov

Nuclear Fuel Cycle Simulation (NFCSim)

D-3 participation in the Advanced Fuel Cycle Initiative (AFCI) program has driven the development of the Nuclear Fuel Cycle Simulation (NFCSim) codes. NFCSim is an event-driven, fully time-dependent simulation code that models the flow of materials through the nuclear fuel cycle (NFC). NFCSim tracks mass flow, as shown in the figure, at the level of discrete reactor fuel charges/discharges with arbitrarily fine time resolution, logging the history of nuclear material (i.e., location, residence time, mass, isotopic composition, heating rate, and toxicity) as it progresses through a detailed series of processes and facilities.

The model internally generates lifecycle material balances for an arbitrary number of reactors and includes a process cost database. The salient features inherent to each process or facility are also simulated. For example, the burning of fuel is simulated with approximate burnup calculations tailored to the time-varying characteristics of the specific reactor and batch. Nuclear decay of spent nuclear fuel (SNF) is also simulated, as is any chemical processing associated with recycling SNF. NFCSim can also simulate an arbitrary number of reactors and associated facilities. The model's reactor and fuel cycle modeling capabilities include light-water-reactor-oriented fuel cycles with the option of actinide recycling and a suite of fast reactors or accelerator driven systems for closure of the nuclear fuel cycle. A demand function for nuclear energy can be specified and NFCSim deploys new facilities as needed, subject to additional exogenously specified constraints such as limitations on the capacity of reprocessing facilities. Using a database of the current U.S. nuclear infrastructure (mines, conversion, fabrication, and enrichment plants) as the point of departure, NFCSim determines the time-dependent demand for these services. As such, NFCSim is an ideal tool for analyzing the economics, sustainability, impact on repositories (mass, heat load, radiotoxicity), and proliferation resistance of non-equilibrium, interacting, or evolving reactor fleets.

Recently International Atomic Energy Agency Director General Mohamed ElBaradei proposed a regional nuclear economy model in which consumer states would operate nuclear reactors constructed and fueled by producer states. President Bush endorsed this proposal, taking it one step further by suggesting that the producer states be restricted to those states that already have the nuclear infrastructure for fabricating and reprocessing fuel. Such a nuclear economy would result in a large volume of nuclear materials transported globally. NFCSim is an ideal tool to analyze the



NFCSim tracks the flow of neclear materials at charge level thoroughout the nuclear fuel cycle.

risks inherent with such nuclear traffic. The NFCSim tool can provide the Global Threat Reduction Initiative which is overseen by the DOE's Office of Global Threat Reduction (NA-21), with the type of analyses that could reduce the long-term threats associated with a global nuclear economy, as proposed by ElBaradei and endorsed by Bush.

The AFCI team developed the NFCSim code and successfully benchmarked it against the French Atomic Energy Commission code, COSI. The team also presented the first results at GLOBAL 03 in November of 2003. We released Version 3.0 of the code to Argonne National Laboratory, Sandia National Laboratory, Idaho National Laboratory

(INL), and FZK Karlsruhe in FY04. We released Version 3.5, which has a graphical user interface (GUI) to facilitate easier data entry, to Royal Institute of Technology, Stockholm, Sweden, in FY05.

NFCSim project collaborators are Argone National Laboratory, Brookhaven National Laboratory, Idaho National Laboratory, Lawrence Livermore National Laboratory, Oakridge National Laboratory, and Sandia National Laboratory. ■

POINT OF CONTACT

Chuck Bathke, D-3
phone: (505) 667-7214
email: bathke@lanl.gov

The Analyst's Work Station

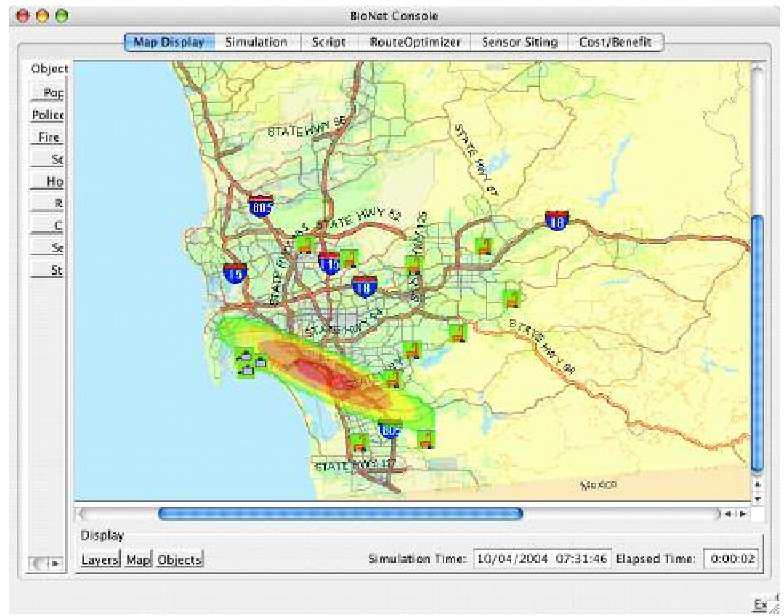
The BioNet program is testing technologies for the next generation of biological-threat detection programs. In support of the program, The Systems Engineering and Integration group (D-3) is developing the Analyst's Work Station (AWS) as an integrating, analytical software tool. The ultimate goal of the AWS is to provide decision makers with a comprehensive tool to answer multivariate questions such as the optimal number and configuration of biodetection units for cities. Optimality in this case encompasses a number of factors, including population coverage, probability of detection, and cost of the system. The AWS will provide a framework for such complex analysis.

Our internal goal was to create a prototype tool rapidly, for low cost, building on the capabilities that already exist within the Division. We used our previous experience with Geographical Information System (GIS) databases, reused the Biological Aerosol Sentry and Information System (BASIS) software for the software framework, and focused on the rapid inclusion of applications developed in other programs. We also wanted a tool that can investigate reach-back and grid computing approaches to analysis.

We now have a prototype that we can use to examine the hypothetical effects of a biological aerosol attack on a population and infrastructure. Using this tool, we can optimize sensor locations to reduce the chances of an undetected release, to protect the largest possible population, or both. Once sensors are located, the routes used to service the sensors can be optimized to balance the work load and minimize the total time spent servicing the sensors. Results from the analysis tools can be moved to the map to aid in visualizing the analysis. In addition, biological aerosol releases can be simulated and visualized to aid in training decision makers. Simulations can be scripted in a text editor, or, alternatively, manually placed sensors, locations, routes, etc., can be added to the map, and then sent to the script editor for saving in a script file.

The Environmental Protection Agency provided us with cost data from the BioWatch program. We are analyzing that data to develop a cost and budgeting tool for inclusion in the prototype. We are investigating two different approaches to move to a true GIS mapping system to improve the flexibility of the prototype. And finally, we will start building the formal software links to automate the reach-back capability for expert analysis needs, such as event reconstruction.

Future plans for advancing the prototype include improving the fidelity of the population database, improving the usability of the tools so the prototype can be used by BioWatch cities with minimal staff training, adding the cost model, improving the GIS and mapping capabilities, and automating the reach-back analysis capability. Day and night population databases exist for California and, in a separate program, a methodology had been developed to transition between the day and night populations. Eventually, we want to include the 24-hour populations for all major metropolitan statistical areas into the tool. The tools are useable now by a trained analyst, but we are working to improve the user interface and providing manuals and training programs to train less highly skilled workers.



The work station can be used to visually integrate what-if scenarios, such as bio-agent releases, with operational data such as sensor locations.

The AWS shows how cross-disciplinary teams, and the results of disparate programs within the division, can be integrated to provide a quick and useful tool for homeland defense. In addition, the prototype will be used internally as a research tool to further division goals, such as the grid-computing initiative. ■

POINT OF CONTACT:

Kristin Omberg, D-3
phone: (505) 667-9628
email: komberg@lanl.gov

John St Ledger, D-3
phone: (505) 667-1154
email: stledger@lanl.gov

Water Infrastructure Interdependencies

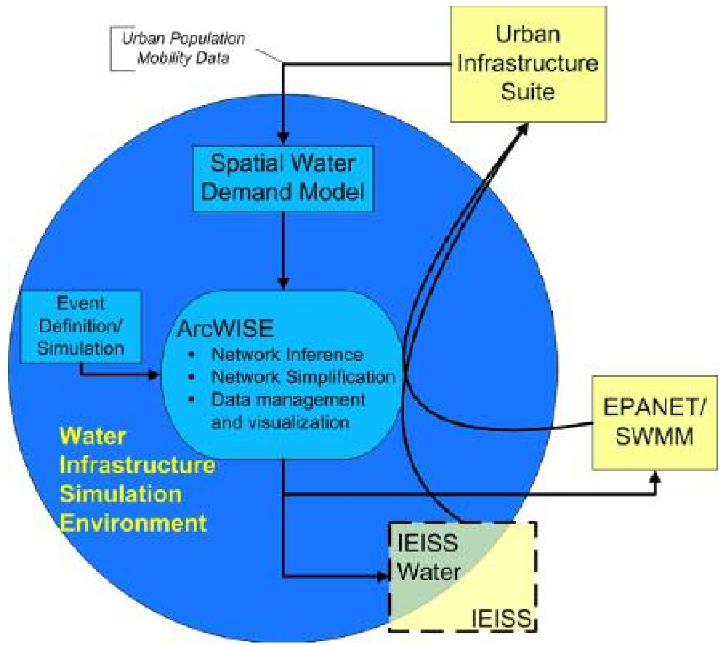
Water is the lifeblood of society. Not only is potable water a necessity for human health, water is also used in fire protection, waste conveyance, electricity generation, industrial processes, and irrigation, as well as a multitude of other uses. For these reasons, people have developed complex sets of infrastructures to adapt natural hydrology to the benefit of humanity. These infrastructures control water at its source, import and distribute water to human settlements, treat and disperse the subsequent significant quantity of waste-ridden water, and address the impacts of modifications to the natural hydrologic cycle on other infrastructures. Loss of one or many of these capabilities can significantly impact human health and socioeconomic well-being. The maintenance and protection of water infrastructure is, therefore, critical to the economic and social health of the United States.

Water infrastructures are a complex system of systems that can be divided into three components:

1. Water distribution: supply, treatment, and distribution of potable water for human consumption, waste conveyance, fire protection supply, and industrial/commercial uses.
2. Sewage collection: collection, treatment, and disposal of wastewater.
3. Stormwater: collection, treatment, and disposal of stormwater runoff.

Each of these infrastructures is inexorably linked with the others. Water distribution systems are the primary source for water in the wastewater collection system; storm sewer systems can feed into the sanitary sewer system; potable water from the municipal drinking water system enters the storm drain system as nuisance flows; and discharged treated wastewater and storm water can enter a surface water body that subsequently may be used as an urban water supply. The planning, design, operation, and maintenance of these water infrastructures has typically considered them as autonomous units. This approach led to the development of world-class water infrastructure in the United States; however, to protect these critical infrastructures, we need to understand the interdependencies between water infrastructures and other critical infrastructures. The existing modeling and simulation technology base has a single infrastructure focus and does not account for interdependencies. The Laboratory, with its extensive history of success studying infrastructure interdependencies and other complex nonlinear systems in support of U.S. national security, is adapting its capabilities to study water infrastructure interdependencies.

The interdependent nature of water infrastructure.



The analytical framework for the Water Infrastructure Simulation Environment.

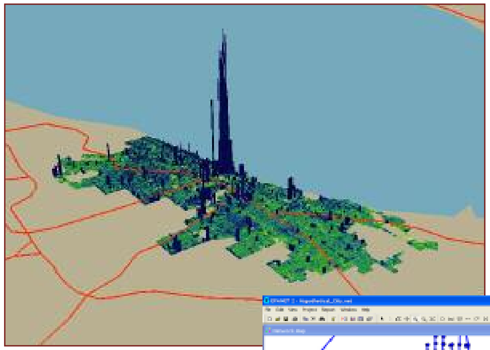
The Water Infrastructure Simulation Environment (WISE) is an analytic framework that evaluates water infrastructure in terms of both infrastructure-specific and interdependency issues. WISE integrates geographic information systems with a wide range of infrastructure analysis tools including industry standard hydraulic simulation engines e.g., EPANET and the Storm Water Management Model, as well as the Laboratory's interdependency simulation systems such the Urban Infrastructure Suite and IEISS.

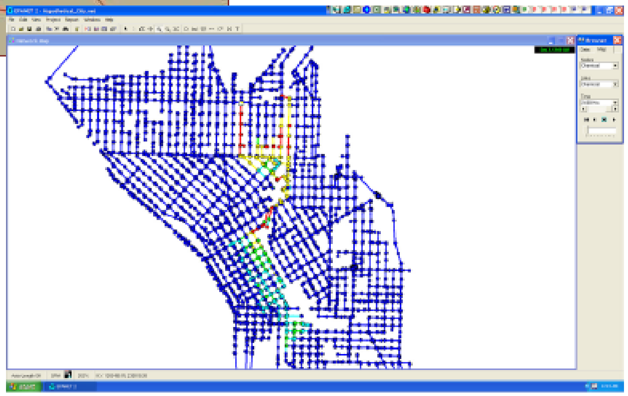
Key components in the WISE framework are ArcWISE, a GIS-based graphical user interface, and IEISS Water, a water infrastructure interdependency simulation capability within IEISS. ArcWISE leverages the existing data management, analysis, and display capabilities within geographic information systems while also extending them to infer, improve, and amend water infrastructure data in support of running hydraulic simulation engines such as EPANET or IEISS Water. ArcWISE also provides tools for defining and simulating infrastructure damage events, such as a fire, and generating water demand/sewage production estimates. IEISS Water is an extension of the IEISS analysis software to water distribution infrastructure simulation. Like other hydraulic simulation engines, IEISS Water provides the ability to simulate the physical behavior of water infrastructures, but more importantly IEISS Water accounts for the nonlinear dynamics within and between water infrastructures and other critical infrastructures. IEISS Water provides capabilities to identify critical components, define system vulnerabilities, simulate scenarios, screen possible interdependency contingencies, and define service areas and outage areas. These infrastructure interdependency capabilities are a significant advance over most water infrastructure simulation systems, making IEISS Water an important tool for homeland security. ■

POINTS OF CONTACT

Tim McPherson, D-3
phone: (505) 665-8762
email: tmac@lanl.gov

Randy Michelsen, D-DO
phone: (505) 665-1522,
email: rem@lanl.gov





Water demand in the city of Chicago.

Infrastructure Emergency Planning

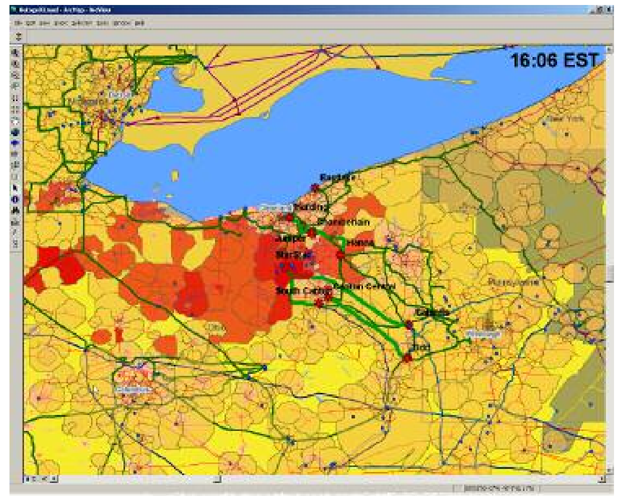
D Division analyzes and characterizes the consequences of attacks on a diverse set of infrastructures such as electric, natural gas, pipeline, telecommunications, and transportation networks. Our tools focus on both normal and off-normal conditions arising within each regional infrastructure or within a local network serving one or more sites of interest. Site-specific analysis can also include service and outage area estimates where appropriate, as well as estimates of outage duration based upon component criticality considerations. Additional attention is often given to system-level metrics that indicate degradations to commercial delivery capability and to varying system conditions throughout a typical year.

Network analyses will often include three components: regional system analysis, local operational area analysis, and on-site analysis. These analyses will use both quantitative and qualitative processes, with a greater opportunity to use quantitative processes the closer the network is analyzed to the site of interest. In electric networks, for example, identification of transmission/subtransmission lines critical for power transfer with adjacent control areas, within the control area, subtransmission system configuration, and generating units available to support local system demand and voltage stability are considered.

Modeling of network performance is a fundamental part of the analysis process and is used as a verification tool, as an estimation tool of system performance under adverse operating conditions, for representation of the infrastructure in a geographic information system format, and for graphic presentations in written reports.

We are continuing to refine IEISS. IEISS simulates the physical and operational behavior of interdependent energy infrastructures during incidents and disruptions. It can identify and rank critical components across energy infrastructures, estimate outages, and quantify feedback.

The primary advantage of this analysis tool is its ability to model the interdependencies between energy networks and identify how particular physical components of these systems behave during disturbances and contribute to their severity. This ability allows us to measure the criticality of assets in a consistent manner across energy infrastructures and to assess the potential for feedback between energy transmission systems (cascading failures). It is possible to examine hundreds or thousands of possible scenarios quickly in order to pinpoint what caused the most severe impacts. We can also determine the geographic extent of service outages, including which customers are affected.



Analysis of initial outage areas for the Northeast Blackout

The outputs of IEISS are (1) complete state information for all of the energy system components after an incident/disturbance; (2) lists of outaged and damaged components; (3) geographic areas without service from particular infrastructures; (4) traces of feedback between infrastructures. Information from multiple runs can be combined to rank the criticality of energy assets. IEISS can handle electric power, natural gas, and petroleum transmission systems and train emergency personnel in each of these domains.

The group's analysis capabilities played a significant role in predicting outage areas and restoration times associated with the vicious hurricane season in Florida in 2004. A USA Today article published on November 21, 2004, noted that Laboratory researchers were able to model the hurricanes' effects on infrastructure before the storms made landfall. Authorities used the Los Alamos outage maps to identify areas that would need immediate help. ■

POINT OF CONATACT

Loren Toole, D-4
phone: (505) 667-9180,
email: ltoole@lanl.gov

NORAD Contingency Suite Test Bed

The NORAD Contingency Suite (NCS) test bed was constructed immediately following the terrorist attacks of September 11. The intent was to assess architectures that would allow the North American Aereospace Defense Command (NORAD) to receive track feeds of inland aircraft that have been designated as "of interest."

A conceptual view of the NCS architecture is shown in Figure 1. This architecture builds on the existing Federal Aviation Agency (FAA) and NORAD architecture with minimal interfaces, bandwidth impact, and procedural changes. The major enhancement to the existing architecture is the addition of Multi-Source Correlation Trackers (MSCT). Plot data from both coastal and inland radars that feed the FAA and NORAD systems also feed to the MSCT.

In addition to the radar feeds, the MSCT has an FAA track feed from the Automated Air Movement Data System (AAMDS) so that FAA attributes, such as commercial call signs, are associated with tracks. Finally, the MSCT has a track feed into NORAD by way of the FYQ93 command and control system; however, only tracks identified by the FAA as "of interest" and subsequently hooked by an MSCT operator are forwarded.

NCS TEST BED

The NORAD Contingency Suite (NCS) was stimulated by a simulation environment hosted on a set of Sun workstations. The main objective was to verify that the (MSCT) correlator could maintain tracks in the event that the FAA feed (TzBz messages stream) is degraded or lost.

To achieve the primary objective, the simulation environment was configured to

1. Accurately represent the location of CONUS-based long-range radars (LRRs)
2. Accurately represent radar equipment characteristics
3. Provide a representative airplane density in the air space
4. Provide accurate commercial aircraft fight plans
5. Provide military interceptor representation
6. Provide authentic radar plot messages through serial-synchronous communications
7. Provide FAA message formats (AAMDS TzBz) for processed air tracks
8. Allow IFF Mode 3c to be selectively turned off
9. Reconstruct various high-interest scenarios (Figure 4)

The NCS test bed is shown in Figure 2. The test bed consists of a MSCT connected to the SABRE simulation model. SABRE is configured with its synthetic radar generation capability and an AAMDS TZ/BZ generator. A northeast sector database containing airports, enroute radars, and commercial aircraft defines the object lay down. The MSCT is receiving plot data from SABRE's synthetic radars by way of MPS 800s using a synchronous serial protocol. Plot data is currently formatted as Korean FPS-117 plot data. ARSR 4 radar plot data will be used when development is completed. SABRE is also generating AAMDS TZ and BZ track messages and sending them to the MSCT through an asynchronous serial interface at a one-minute update rate.

Northeast sector radars modeled are Benson, Canton, Clearfield, Dansville, Horicon, Indianapolis, Joliet, London, Lynch, North Truro, St.Louis, Suffolk, and The Plain.

Airports modeled are Boston Logan, JFK, Burlington International, Newark Liberty International, Manchester International, LaGuardia, Pitts Town, Dulles, Philadelphia International, Pittsburgh International, Detroit Metropolitan, and St. Louis International.

The load consists of 150 commercial flights departing from the above airports over a 90-minute interval.

The MSCT correlated and tracked the plot data and the AAMDS data with the tracks. With the integration of the AAMDS TZ and BZ messages into the MSCT, an operator did identify inland tracks by civilian call sign. Subsequent hooking and forwarding of the hooked track to the USAF Region was not demonstrated.

In addition, through extensive test efforts completed on the Korean Tactical Digital Information Links (TADIL) Architecture Improvement Plan (KTAIP) Program using an analogous simulation environment, the MSCT was rated as superior in a sequence of measures of performance (MOP). The aggregate of data collected during KTAIPs and NCS testing indicates a substantial improvement in air defense situational awareness is achievable in the near term. The recommended MCST will provide a suitable interim capability pending full-scale development of the North American air defense infrastructure. ■

POINT OF CONTACT

Mike Koscielniak, D-4
phone: (505) 665-5673
email: mkosciel@lanl.gov

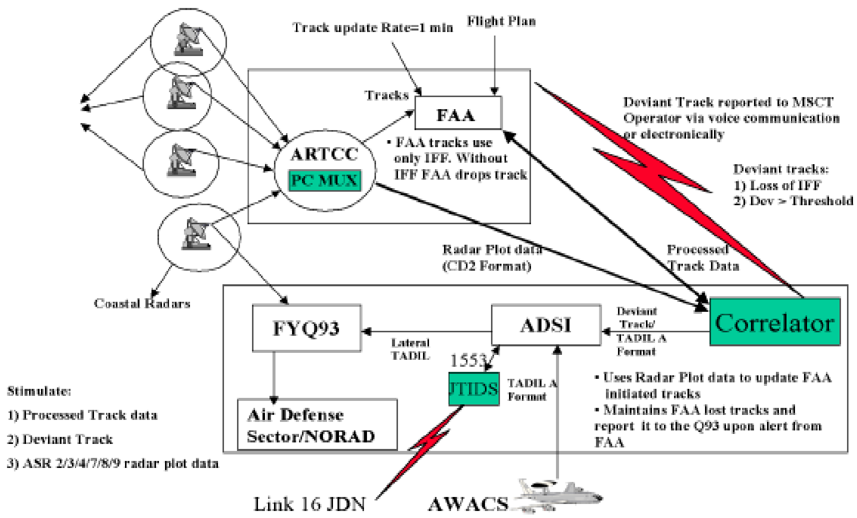


Figure 1. NORAD contingency suite architecture.

Figure 3. September 11th scenario (at approximately 8:25 a.m., EST).

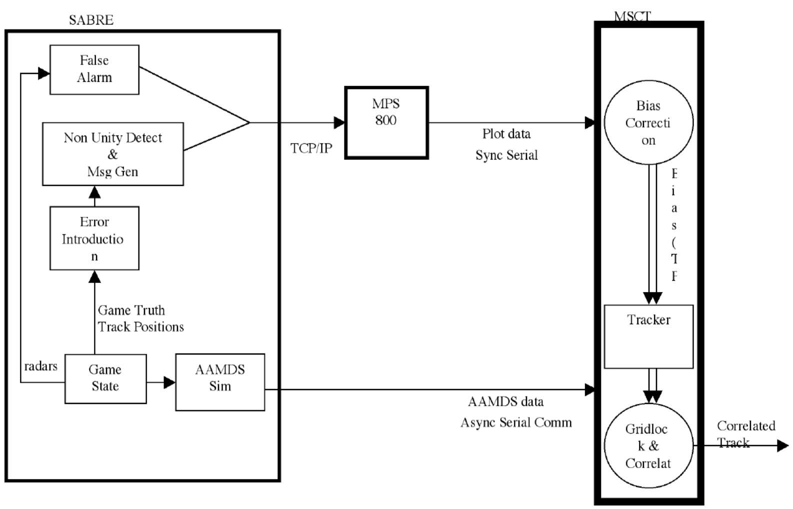


Figure 2. NCS test bed configuration.

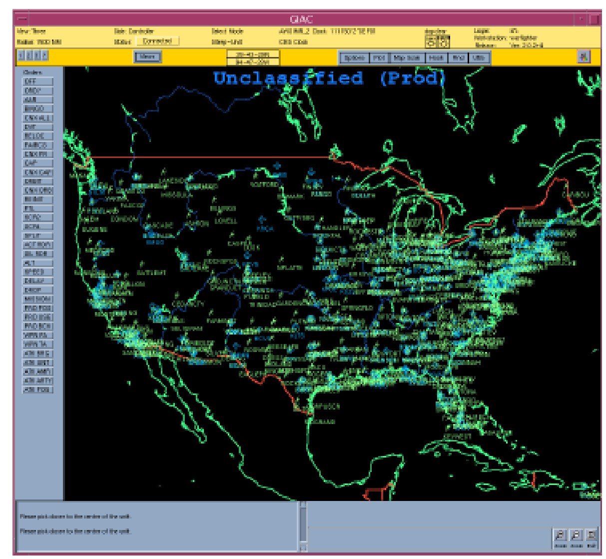


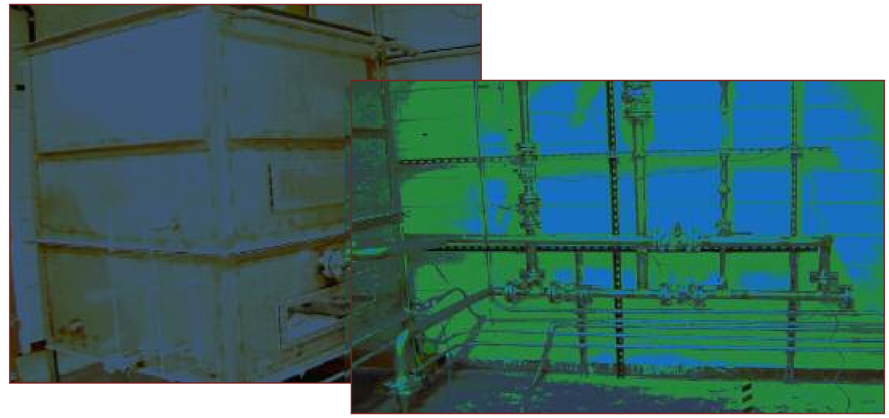
Figure 4. CONUS radar and airport locations.

Integrated Chemical Effects Tests (ICET)

Containment buildings of pressurized water reactors (PWRs) are designed to contain radioactive material releases and to remove the residual heat generated in the reactor core in case of a postulated LOCA. The water collected in the sump from the reactor coolant system and the containment spray system is recirculated to the reactor core to remove residual heat. The sump contains a screen that protects system structures and components in the containment spray and the ECCS flow paths from the effects of debris that could be washed into the sump. There are concerns that fibrous insulation material could form a mat on the screen, which would obstruct flow, and that chemical reaction products such as gelatinous or crystalline precipitants could migrate to the screen, causing further blockage and increased pressure-head losses across the debris bed.

D-5's Integrated Chemical Effects Tests (ICET) series represents a joint effort by the NRC and the nuclear utility industry. ICET simulates the post-LOCA chemical environment present inside a containment structure and monitors the chemical system for an extended period of time to identify the presence, composition, and physical characteristics of chemical products that may exacerbate debris-bed flow losses. Among the many objectives, should products of this nature be found during the ICET series, are determining the cause and potential quantity of the products and characterizing their head-loss properties in combination with fibrous debris. LANL at the University of New Mexico, with the assistance of professors and students in the civil engineering department, are conducting the ICET series.

The ICET series is a limited-scope suite of five different initial conditions. Each test lasts between 15 and 30 days. In brief, the ICET apparatus consists of a large stainless-steel tank with heating elements, spray nozzles, and a circulation pump to simulate the post-LOCA chemical environment. Samples of structural metals, concrete, and insulation debris are scaled in proportion to their relative surface areas found in containment and in proportion to a maximum test dilution volume of 250 gallons of circulating fluid. Representative chemical additives, temperature, and material combinations are established in each test and then the system is monitored while corrosion and mixing occur for a duration comparable to the ECCS recirculation mission time. The first of the five tests was completed December 21, 2004, and the second test is now in progress. In Test 1, precipitants from the test solution that formed upon cooling are being identified and studied for possible adverse head-loss effects. ■



Integrated Chemical Effects Testing containment structure.

POINTS OF CONTACT

Bruce Letellier, D-5
phone: (505) 665-5188
email: bcl@lanl.gov

Robert (Jack) Dallman, D-5
phone: (505) 699-1315
email: jdallman@lanl.gov

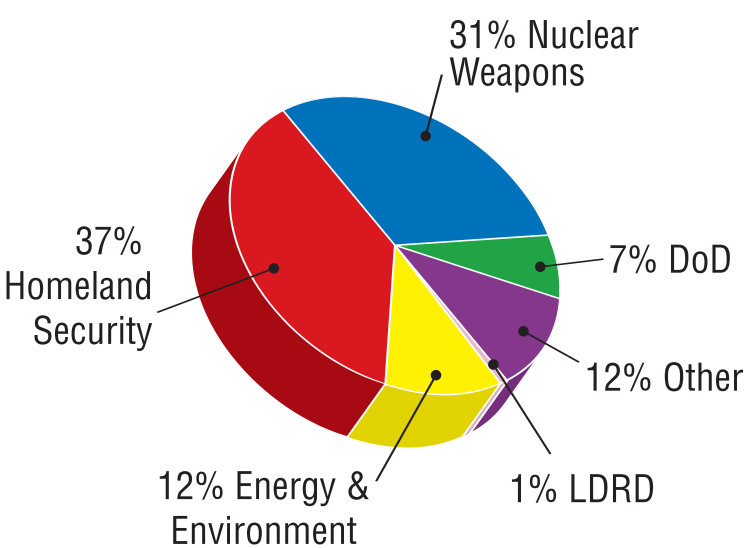
Large mass of sludge on gently lifted rod. Material easily disaggregates when slipping off of the rod and becomes suspended as fine particles in the liquid.

Decision Applications Division

Appendix

Decision Applications Division Statistics

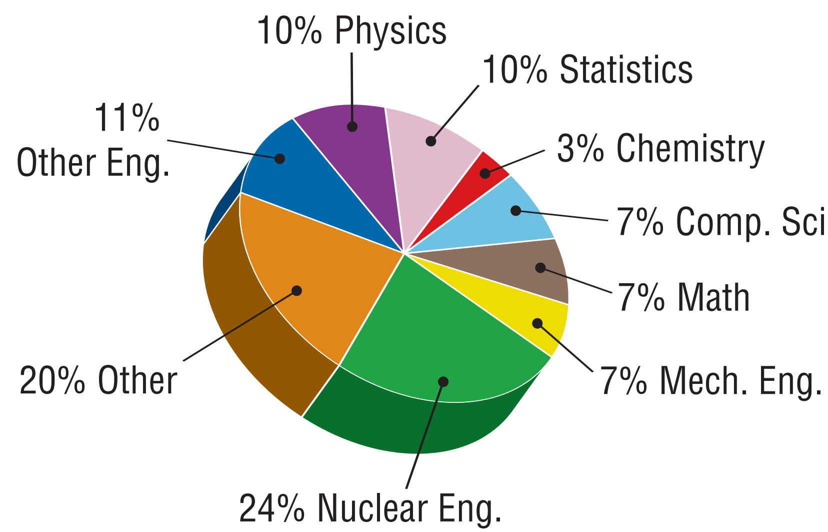
Fiscal Year 2005 (FY05) projected budget by focus area—$65.5 million in total*.



Nuclear Weapons	31%	$20.3 M
DoD	7	4.6
Other	12	7.9
LDRD	1	0.6
Energy & Environment	12	7.9
Homeland Security	37	24.2

* *December 2004 projection*

Technical staff members (TSMs) in the division by discipline—178 TSMs in total.



Nuclear Engineering	24%	43
Mechanical Engineering	7	12
Mathematics	7	13
Computer Science	7	13
Chemistry	3	6
Statistics	10	17
Physics	10	18
Engineering Other	11	20
Other Disciplines	20	36

Acronyms and Abbreviations

A
ACTD Advanced Concepts Technology Development
AFCI Advanced Fuel Cycle Initiative
AFLP amplified fragment length polymorphisms
ASA American Statistical Society
AWS Analyst's Work Station

B
BASIS Biological Aerosol Sentry and Information System

C
CMR Chemistry Metallurgy Research
CONUS continental United States
CREM classified removable electronic media

D
DHS Department of Homeland Security
DoD Department of Defense
DOE Department of Energy
DT Defense Transformation
DTRA Defense Threat Reduction Agency

E
ECCS Emergency Core Cooling System
EITAC Energy Infrastructure Training and Analysis Center
EP Enterprise Project
EPA Environmental Protection Agency

F
FSP Facility Strategic Plan

G
GIS geographical information system
GUI graphical user interface

H
HI Horizontal Integration

I
ICET Integrated Chemical Effects Tests
IEISS Interdependent Energy Infrastructure Simulation System
IIT Information integration technology

J K
KDD Knowledge Discovery and Dissemination

L
LAMPS Lean Agile Manufacturing Prototype System
LANL Los Alamos National Laboratory
LASC Los Alamos Science Complex
LOCA loss of coolant accident

M
MCMC Markov chain Monte Carlo
MCNPX Monte Carol Neutron Photon Extended
MDA Missle Defense Agency
MPF Modern Pit Facility

N
NASA National Aeronautics and Space Administration
NFC nuclear fuel cycle
NFCSim Nuclear Fuel Cycle Simulation
NISAC National Infrastructure Simulation and Analysis Center
NNSA National Nuclear Science Administration
NRC Nuclear Regulatory Committee
NW nuclear weapons

O
OR/SA operations research/systems analysis

P Q

QUIC Quick Urban and Industrial Complex

R

RNEP Robust Nuclear Earth Penetrator

S

S&T science and technology
SLD second line of defense
SNF spent nuclear fuel
SNM special nuclear materials

T

TITANS Theoretical Institute of Thermonuclear and Nuclear Studies
TRANSIMS transportation simulator
TTD Tunnel Target Defeat
TRAC Transient Reactor Analysis Code

U

UC University of California
UNWD Unconventional Nuclear Warfare Defense

V W

WISE Water Infrastructure Simulation Environment
WMD weapons of mass destruction
WP weapons program
WR war reserve

XYZ

YADAS Yet Another Data Analysis System
■

Professional Organizations

D Division is represented in the following professional organizations:

Air and Waste Management Association
American Anthropological Association
American Association for Rhetoric of Science and Technology
American Association for the Advancement of Science
American Chemical Society Association for Women in Science
American Economic Association
American Institute of Aeronautics and Astronautics
American Institute of Chemical Engineers
American Mathematical Society
American Nuclear Society
American Physical Society
American Rock Mechanics Association
American Society of Civil Engineers
American Society of Mechanical Engineers
American Society of Nuclear Engineers (ASNE)
American Society for Photogrammetry and Remote Sensing
American Society for Testing and Materials
American Sociological Association
American Statistical Association (ASA)
Association of Aviation Psychologists
Association for Computing Machinery
Association for Women in Science
Health Physics Society
Human Factors and Ergonomics Society
Institute of Electrical and Electronics Engineers (IEEE), APS, ACM
Institute of Mathematical Statistics
Institute for Operations Research and the Management Sciences (INFORMS)
Institute of Nuclear Material Management
Interface Foundation of North America
International Association of Energy Economists
International Society for Analytical Cytology
International Society for Bayesian Analysis (ISBA)
International Society for Optical Engineering (SPIE)
International Society for Rock Mechanics
International Society of Soil Mechanics and Foundation Engineering
International Test and Evaluation Association
LANL Reactor Safety Committee
Mathematical Association of America
Military Operations Research Society
National Academy of Sciences Panel on Estimating
New Mexico Network for Women in Science and Engineering
Operations Research Society of America
Phi Beta Kappa
Program Committee for the 2004 Congress on Evolutionary Computation
Project Management Institute
Rhetoric Society of America
Sigma Pi Sigma Physics Honor Society
Sigma Xi
Society of Environmental Toxicology and Chemistry
Society for the History of Technology
Society for Industrial and Applied Mathematics (SIAM)
Society of Mining Engineers of AIME
Society of Professional Engineers
Society for Risk Analysis
Society for Social Studies of Science
Tau Beta Pi

D Division Publications, Conferences, & Reports for 2004

Publications

Adams, D.B., L.T. Watson, Z. Gurdal, and C.M. Anderson-Cook, "Genetic Algorithm Optimization and Blending of Composite Laminates by Locally Reducing Laminate Thickness," *Adv. Eng. Softw.* **35**, 35–43 (2004).

Anderson-Cook, C.M., H. Goldfarb, C. Borror, D.C. Montgomery, K.G. Canter, and J.A. Twist, "Mixture and Mixture-Process Variables Experiments for Pharmaceutical Applications," *Pharm. Stat.* **3**, 247–260 (2004).

Anderson-Cook, C.M., and A. Ozol-Godfrey, "Using Fraction of Design Space Plots for Informative Comparisons between Designs" (to be published in *Modern Advances in Response Surface Methodology*, Editor: Andre Khuri).

Anderson-Cook, C.M., A. Patterson, and R. Hoerl, "A Structured Problem Solving Course for Graduate Students: Exposing Students to Six Sigma as Part of their University Training" (to be published in *Qual. Reliab. Eng. Intl.*).

Barratt, J.G., and E.A. Schneider, "Monte Carlo Sensitivity Analysis of a Transmuting Fuel Cycle," *T. Am. Nucl. Soc.* **90**, 249 (June 2004).

Biggs, J., S. Sherwood, S. Michalak, L. Hansen, and C. Bare, "Animal-Related Vehicle Accidents at the Los Alamos National Laboratory, New Mexico," *Southwest. Nat.* **49** (3):384–394 (2004).

Bingham, D., N. Hengartner, D.M. Higdon, C. Linkletter, and R. Sitter, "Comparing Designs of Experiment for Screening and Prediction in Computer Experiments," *Proceeding of the 29th Annual JANNAF Conference* (2004).

Burr, T.L., and J. Gattiker, "The Impact of Model Uncertainty on Biological Parameter Estimates," *Far East J. Theor. Stat.* **13**(2), 153–174 (2004).

Burr, T.L., A. Jacobson, and A. Mielke, "A Global Radio Frequency Noise Survey as Observed from the FORTE Satellite at 800-km Altitude," *Radio Sci.* **39**, RS 4005, doi:10.1029/2002RS002865 (2004).

Burr, T.L., M. Krick, and M.A. Mielke, "Statistical Evaluation of Two Triggering Systems: an Application of Conditional Variance," *Nucl. Inst. Methods Phys. Res., Sect. A* **524**, 314–322 (2004).

Byrd, R.C., "Nuclear Detection to Prevent or Defeat Clandestine Nuclear Attack" (to be published in the *IEEE Sensors Journal*).

Chowell, G., N. Hengartner, P. Fenimore, and C. Castillo-Chavez, "Ebola Hemorrhagic Fever: Epidemic Modeling and Estimation" (to be published in *J. Theor. Biol.*).

Crooks, W.J., III, D.R. Spearing, J.A. Rennie, L.A. Worl, and T.L. Burr, "For the Storage of Plutonium Metal, is a Surveillance Program for Pressurization Necessary?" (to be published in *Journal Nuclear Material Management*).

Dattelbaum, D.M., K.M. Omberg, P.J. Hay, N.L. Gebhart, R.L. Martin, J.R. Schoonover, and T.J. Meyer, "Defining Electronic Excited States Using Time-Resolved Infrared Spectroscopy and Density Functional Theory Calculations," *J. Phys. Chem. A.*, **108** (16), 3527 (2004).

Deinert, M.R., and E.A. Schneider, "Reconsidering the Economics of Reprocessing Spent Nuclear Fuel" (submitted to *Proc. Natl. Acad. Sci.*).

Drain, D., W.M. Carlyle, D.C. Montgomery, C.M. Borror, and C.M. Anderson-Cook, "A Genetic Algorithm Hybrid for Constructing Optimal Response Surface Designs," *Qual. Reliab. Eng. Intl.* **20**, 637–650 (2004).

Forslund, D.W., E.L. Joyce, T.L. Burr, R. Picard, D. Woukun, E. Umland, J.C. Brillman, P. Froman, and F. Koster, "Setting Standards for Improved Syndromic Surveillance," *IEEE Engineering in Medicine and Biology* **23**, 65–70 January/February (2004).

Goldfarb, H.B., C.M. Borror, D.C. Montgomery, and C.M. Anderson-Cook, "Evaluation of Statistical Designs for Mixture-Process Variable Experiments with Noise Variables," *J. Qual. Technol.* **36**, 245–262 (2004).

Goldfarb, H.B., C.M. Borror, D.C. Montgomery, and C.M. Anderson-Cook, "Statistical Designs for Mixture-Process Variable Experiments with Control and Noise Variables" (to be published in *J. Qual. Technol.*).

Graves, T.L., and M.S. Hamada, "Biased Reduced Sampling: Detectability of an Attribute and Estimation of Prevalence" (to be published in *Qual. Reliab. Eng. Intl.*).

Graves, T.L., M.S. Hamada, J.M. Booker, C. Bowyer, K. Chilcoat, and M. Decroix, "Estimating a proportion Using Stratified Data Arising from Both Convenience and Random Samples" (submitted to *Technometrics*).

Hamada, M.S., H.F. Martz, and S. Steiner, "Accounting for Mixing Errors in Analyzing Mixture Experiments" (to be published in *J. Qual. Technol.*).

Hamada, M.S., H.F. Martz, C.S. Reese, T. Graves, V. Johnson, and A.G. Wilson, "A Fully Bayesian Approach for Combining Multilevel Failure Information in Fault Tree Quantification and Optimal Follow-on Resource Allocation," *Reliab. Eng. Sys. Safe.* **86** (3), 297–305 (2004).

Hamada, M.S., V. Johnson, L.M. Moore, and J.R. Wendelberger, "Bayesian Prediction Intervals and their Relationship with Tolerance Intervals," *Technometrics* **46**, 452–459 (2004).

Hamada, M.S., and R. Sitter, "Statistical Research: Some Advice to Beginners," *The American Statistician* **58**, 93–101. Discussion and response: 58 196–202 (2004).

Hamada, M.S., H.F. Martz, A.C. Koehler, and E. Berg, "Optimizing the Availability of a Buffered Industrial Manufacturing Process" (submitted to *Reliab. Eng. Sys. Safe*).

Hamada, M.S., "Using Degradation Data to Assess Reliability" (accepted for publication in *Qual. Eng.*).

Hendricks, J.S., G.W. McKinney, L.S. Waters, and F.X. Gallmeier, "New MCNPX Capabilities," in *T. Am. Nucl. Soc.* **90**, p. 475 (2004).

Hendricks, J.S., J.P. Finch, and C. Choi, "Calculation of Eigenfunction Fluxes in Nuclear Systems" (American Nuclear Society Topical Meeting, Radiation Protection and Shielding Division, *ICRS-10/RPS 2004*, Madeira, Portugal, May 10–14, 2004).

Hengartner, N., and S. Sperlich, "Rate Optimal Estimation with the Integration Method in Presence of Many Covariates" (to be published in the *J. Multivariate Anal.*).

Hengartner, N., and M. Wegkamp, "Second Order Asymptotics for Z Estimators," in *The First Erich Lehmann Symposium* – Optimality, Javier Rojo and Victor Perez-Abreu, Eds. (Institute of Mathematical Statistics, Beachwood, OH, 2004), pp. 107–124.

Higdon, D.M., "Discussion of: Nonstationary Multivariate Process Modeling through Spatially Varying Coregionalization," *Test* **13**, 298–303 (2004).

Hill, K.K., L.O. Ticknor, R.T. Okinaka, M. Asay, H. Blair, K.A. Bliss, M. Laker, P.E. Pardington, A.P. Richardson, M. Tonks, D.J. Beecher, J.J. Kemp, A.-B. Kolsto, A.C. Lee Wong, P. Keim, and P.J. Jackson, "Fluorescent Amplified Fragment Length Polymorphism Analysis of *Bacillus anthracis, Bacillus cereus, and Bacillus thuringiensis* Isolates," *Appl. Env. Microbiol.* **70**:1068–1080 (2004).

Jacobson, J., N. Hengartner, and T. Louis, "Measures of Inequitable Proximity to Major Highways in NYC" (to appear in *Environ. Plan. A.*).

Keller-McNulty, S., G. Duncan, and S.L. Stokes, "Database Security and Confidentiality: Examining Disclosure Risk vs. Data Utility through the R-U Confidentiality Map" (under revision for *Manage. Sci. J.*).

Kindinger, J.P., technical reviewer for "Preliminary Considerations Regarding NASA's Bioastronautics Critical Path Roadmap (BCPR)" (The National Academies Press, Washington, D.C., 2005).

Kornreich, D.E., and D.K. Parsons, "Time-Eigenvalue Calculations in Multi-Region Cartesian Geometry using Green's Functions" (to be published in *Ann. Nucl. Energy*).

Lee, H., D.M. Higdon, K. Calder, and C. Holloman, "Spatial Models via Convolutions of Intrinsic Processes" (to be published in *Stat. Model.*).

Lee, H., B. Sanso, W. Zhou, W. and D.M. Higdon, "Inferring Particle Distribution in a Proton Accelerator Experiment" (to be published in *Bayesian Analysis*).

Li, N., and J. Zhang, "Dynamics of High Temperature Oxidation Accompanied by Scale Removal and Implications for Technological Applications" (submitted to *J. Nucl. Mater.*).

Maji, A.K., B. Letellier, K. Ross, DV Rao, and L. Bartlein, "Experimental Validation of CFD Analyses for Estimating the Transport Fraction of LOCA-Generated Insulation Debris to ECCS Sump Screens," *Nuclear Technology Journal* **146**:3, pp. 279–289 (June 2004).

Marron, S., (U. of North Carolina); J. Wendelberger (D-1); and E. Kober (T-14), "Time Series Functional Data Analysis" (submitted to *Journal of Computational Graphics and Statistics*).

Michalak, S.E., K. Harris, N. Hengartner, B. Takala, and S. Wender, "Predicting the Number of Fatal Soft Errors in Los Alamos National Laboratory's ASC Q Supercomputer" (to be published in *the invited IEEE Transaction on Device and Materials Reliability* Special Issue on Soft Errors).

Michalak, S.E., and G.D. Wilson, "Reconsidering Smallpox" (to be published in *Chance* 2005).

Morris, M., L.M. Moore, and M.D. McKay, "Incomplete Factorial Sampling Plans for Evaluating the Importance of Computer Models" (to be published in *JSPI* 2005).

Nakhleh, C.W., and D.M. Higdon, "Discussion of: When Can Finite Testing Ensure Infinite Trustworthiness?" *Journal of the Iranian Statistical Society* **3** (1), 1–37 (2004).

Ozol-Godfrey, A., C.M. Anderson-Cook, and D.C. Montgomery, "Fraction of Design Space Plots for Examining Model Robustness" (to be published in *J. Qual. Technol.* 2004).

Picard, R., "Importance Sampling for Simulation of Markovian Physical Processes," *Technometrics* **47** (to appear 2005).

Prettyman, T.H., G.W. McKinney, et al., "Composition and Structure of the Martian Surface in the High Southern Latitudes from Neutron Spectroscopy," *J. Geophys. Res.* **109** E05001 (May 2004).

Ramos, M.V., and W.E. Gilmore, "The Paperless Shop Floor: Upgrading Procedures from Paper to Computer" (accepted for publication in a future edition of *Ergonomics in Design*).

Reese, C.S.. A.G. Wilson, M. Hamada, H.F. Martz, and K.J. Ryan, "Integrated Analysis of Computer and Physical Experiments," *Technometrics* **46**(2), 153–164 (2004).

Reese, C.S., M.S. Hamada, P. Deininger, and R. Krabill, "Exploring the Statistical Advantages of Nondestructive Evaluation over Destructive Testing" (submitted to *J. Qual. Technol.*)

Reese, C.S., M.S. Hamada, and D. Robinson, "Assessing System Reliability by Combining Multilevel Data from Different Test Modalities" (submitted to *QTQM*).

Schneider, E.A., and C.G. Bathke, "NFCSim: a Dynamic Fuel Burnup and Fuel Cycle Simulation Tool" (*Nucl. Technol.,* in press).

Schneider, E.A., J.G. Barratt, K.B. Cady, and M.R. Deinert, "Visualization of Coupled Spectral and Burnup Calculations: an Intuition-Building Tool" (accepted for publication in *Proc. Amer. Soc. Engr. Education*).

Sheldon, K.E., C.M. Anderson-Cook, and W.F. O'Brien, "Using Computer Modeling to Optimize Cost and Maintain Performance Constraints for Production of Aircraft Turbine Engines," *Qual. Reliab. Eng. Int.* **20**, 541–551.

Sims, B.H., "Safe Science: Material and Social Order in Laboratory Work" (to be published in *Soc. Stud. Sci.* 2005).

Swinhoe, M.T., J.S. Hendricks, and D.R. Mayo, "MCNPX for Neutron Multiplicity Detector Simulation" (submitted to European Safeguards Research and Development Association [ESARDA] Symposium on Safeguards and Nuclear Material Management, London, UK, June 2005).

Talih, M., and N. Hengartner, "Markov Field on Time Varying Graphs" (to be published in the *J. Royal Stat. Soc., Series B*).

Trellue, H.R., "Neutronic and Logistic Proposal for Transmutation of Plutonium from Spent Nuclear Fuel as Mixed-Oxide Fuel in Existing Light Water Reactors," *Nucl. Technol.* **147**:2, pp. 171–180 (2004).

Wilson, A.G., C.S. Reese, M.S. Hamada, and H.F. Martz, "Integrated Analysis of Computer and Physical Experimental Lifetime Data," Chapter 9 in *Mathematical Reliability: An Expository Perspective,* R. Soyer, T.A. Mazzuchi, and N.D. Singpurwalla, Eds. (Kluwer Publishers, Boston, MA, 2004) pp. 183–194.

Wilson, A., M. Hamada, and M. Xu, "A Bayesian Approach for Determining Production Performance and Release Specifications in the Presence of Measurement Error," *J. Qual. Technol.* **36**(2), 193–206 (2004).

Yacout, A.M., R.N. Hill, L. Van Den Durpel, P. Finck, E.A. Schneider, C.G. Bathke, and S.G. Herring, "Dynamic Analysis of the AFCI Scenarios," *Proc. of the Physics of Advanced Fuel Cycles and Nuclear Systems, PHYSOR 2004* (April 2004).

Zhang, J., N. Li, Y. Chen, and A.E Rusanov, "Corrosion Behaviors of US Steels in Flowing Lead-Bismuth Eutectic (LBE)," *J. Nucl. Mater.* **336**, pp. 1–10 (2005).

Zhang, J., and N. Li, "Corrosion/Precipitation in Non-Isothermal and Multi-Modular LBE Loop Systems," *J. Nucl. Mater.* **326**, pp. 201–210 (2004).

Zhang, J., and N. Li, "Review of Studies on Fundamental Issues in LBE Corrosion" (submitted to *Prog. Mater. Sci.*).

Zhang, J., and N. Li, "Oxidation Mechanism of Steels in Liquid Lead-Alloys" (submitted to *Oxid. Met.*).

Zhou, C., K.L. Summers, T.P. Caudell, K. Berkbigler, B. Bush, K. Davis, and S. Smith, "Graph Visualization for the Analysis of the Structure and Dynamics of Extreme-Scale Supercomputers," *J. Information Visualization* **3**, 209–222 (2004).

Conferences and Presentations

Anderson-Cook, C.M., L. Liang, and T.J. Robinson, "Graphical Design Assessment Tools for Split-Plot Designs" (Fall Technical Conference, Roanoke, VA, October 12–16, 2004).

Anderson-Cook, C.M., A. Ozol-Godfrey, and R.H. Myers, "Graphical Methods for Design Assessment for Designs Involving Generalized Linear Models" (Invited Talk at Joint Statistical Meetings of the American Statistical Association, Toronto, Canada, August 12–14, 2004).

Bagal, N., E. Pardyjak, and M. Brown, "Implementation of a Rooftop Recirculation Parameterization into the QUIC Fast Response Urban Wind Model" (5th AMS Symposium on the Urban Environment, Vancouver, B.C., August 23–27, 2004).

Bingham, D., E. Kelly, L.M. Moore, D. Olivas, and R. Sitter, "A Grouping Scheme for Conducting Experiments in Several Stages" (Spring Research Conference on Statistics in Industry and Technology, Gaithersburg, MD, May 19–21, 2004).

Brown, M., "Urban Dispersion - Challenges for Fast Response Modeling" (5th AMS Symposium on the Urban Environment, Vancouver, B.C., August 23–27, 2004).

Brown, M., A. Ivey, T. McPherson, D. Boswell, and E.R. Pardyjak, "A Study of the Oklahoma City Urban Heat Island Using Ground Measurements and Remote Sensing" (5th AMS Symposium on the Urban Environment, Vancouver, B.C., August 23–27, 2004).

Burian, S., M. Brown, J. Ching, M. Cheuk, M. Yuan, W. Han, and A. McKinnon, "Urban Morphological Analysis for Mesoscale Meteorological and Dispersion Modeling Applications: Current Issues" (5th AMS Symposium on the Urban Environment, Vancouver, B.C., August 23–27, 2004).

Burr, T., C. Boyle, M. Baker, P. Felsher, M. Frank, G. Hemphill, B. Martinez, and L. Ticknor, "Tool for Inventory Difference Evaluation with Flexible Material Balance Areas" (2004 Annual Institute of Nuclear Material Management [INMM] Meeting, Orlando, Florida, July 18–22, 2004).

Bush, B.W., "Critical Infrastructure Protection Decision Support System: Case Study Example" (2005 Annual Meeting, Society for Risk Analysis, Palm Springs, CA, December 7, 2004).

Campbell, K., "A Brief Survey of Statistical Model Calibration Ideas" (tutorial presented at 4th International Conference on Sensitivity Analysis of Model Output [SAMO], Santa Fe, NM, March 8–11, 2004).

Campbell, K., M. McKay, and B. Williams, "Sensitivity Analysis When Model Outputs are Functions" (4th International Conference on Sensitivity Analysis of Model Output

[SAMO], Santa Fe, NM, March 8–11, 2004).

Choi, M.M., T.J. Farish, and V.P. Worland, "Evaluation of Los Alamos National Laboratory's Transuranic Radioactive Liquid Waste Treatment Capability and Recommendations for Its Future Design" (submitted to the Waste Management '05 Symposium, Tucson, AZ, February 27–March 3, 2005).

"CIP/DSS Project Overview, Metropolitan Models, and Telecommunications Case Study," Presentation to Alex de Alvarez, Director of Office of Energy Assurance, U.S. Department of Energy, Los Alamos National Laboratory, Los Alamos, NM, October 29, 2004.

"CIP/DSS Metropolitan Model and Telecommunications Case Study," Japan-US Technical Exchange on CIP Interdependency Modeling, Science & Technology Directorate of U.S. Department of Homeland Security, Albuquerque, NM, October 13, 2004.

"Contingency Screening Heuristics in IEISS," NISAC Technical Review, Protective Services Division, U.S. Department of Homeland Security, Albuquerque, NM, October 7, 2004.

"Critical Infrastructure Protection Decision Support System," CIP Modeling & Simulation Workshop, Science & Technology Directorate, U.S. Department of Homeland Security, Arlington, VA, November 8, 2004.

Doak, J., T.L. Burr, D. Moore, and J. Schaefer, "Modeling of a Fuel Fabrication Facility using Python and SimPy" (Pycon 2004, Washington D.C., March 24–26, 2004).

Finch, J.P., J.S. Hendricks, and C.K. Choi, "Vacation Matrix Method for Correct Source Distribution in Monte Carlo Criticality Calculations" (submitted to Monte Carlo 2005, Chattanooga, TN, April 17–21, 2005).

Gilmore, W.E., and N.G. Brannon, "Usability Evaluation of Computerized Operating Procedures in a High-Consequence Industrial Workplace" (accepted for conference, HCI International 2005, July 22–27, 2005, Las Vegas, Nevada).

Graves, T.L., and M.S. Hamada, "Bayesian Methods for Assessing System Reliability: Models and Computation" (Fourth International Conference on Mathematical Methods in Reliability, Santa Fe, NM, June 21–25, 2004.)

Graves, T.L., P.L. Speckman, and D. Sun, "Intuitive, Easily Programmed Steps that Reduce MCMC Autocorrelation" (Joint Statistical Meetings of the American Statistical Association, Toronto, Canada, August 12–14, 2004).

Greening, L.A., and E.A. Schneider, "Pathway to a Hydrogen Economy: What Path to Follow?" (24th International Association for Energy Economics, North American Conference, Washington D.C., July 8–10, 2004).

Heasler, P., T.L. Burr, B. Reid, C. Gesh, and C. Bayne, "Estimation Procedures and Error Aanalysis for Inferring the Total Plutonium Procuded by a Graphite-moderated Reactor" (4th International Conference on Sensitivity Analysis of Model Output [SAMO], Santa Fe, NM, March 8–11, 2004).

Hendricks, J.S., and G.W. McKinney, "Pulse-Height Tallies with Variance Reduction" (submitted to Monte Carlo 2005, Chattanooga, TN, April 17–21, 2005).

Hendricks, J.S., and J.M. Burward-Hoy, "Monte Carlo Radiation Detector Modeling in Space Systems" (submitted to Space Nuclear Conference [SNC '05], San Diego, CA, June 6–9, 2005).

Hendricks, J.S., G.W. McKinney, J.W. Durkee, M.R. James, D.B. Pelowitz, and H.R. Trellue, "The MCNPX Radiation Transport Code" (submitted to M&C 2005, the International Topical Meeting on Mathematics and Computation, Avignon, France, September 12–15, 2005).

Hengartner, N., "Stockpile Reliability Assessment" (Conference on Mathematical Methods in Reliability, Santa Fe, June 21–25, 2004).

Hengartner, N., "Bionet and the Challenges of Academic Work in Homeland Security" (Conference on Statistics in Counterterrorism, New York, November 20, 2004).

Hengartner, N., "Stochastic Epidemic Modeling on Social Network" (CNLS, December 2004).

Hengartner, N., and A.G. Wilson, "Stockpile Reliability Assessment" (Mathematical Methods in Reliability Conference, Santa Fe, NM, June 21–25, 2004).

Higdon, D.M., "Space-Time Modeling" (Invited lecturer at *Semstat 04,* Munich Germany, December 12–18, 2004).

Higdon, D.M., "Simulator-aided Inference for Multivariate Field Data and Simulator Output" (Invited speaker at *ISBA World Meeting,* Viña del Mar, Chile, May 23–27, 2004).

Higdon, D.M., "Simulator-aided Inference for Multivariate Field Data and Simulator Output" (V & V *Foundations '04 Workshop,* Phoenix, AZ, September 2004).

Higdon, D.M., "A Framework for Uncertainty Quantification Combining Detailed Computer Simulations and Experimental Data" (Invited speaker at the *Workshop on Computer Model Evaluation,* Banf, Canada, July 2004).

Higdon, D.M., "A Framework for Uncertainty Quantification Combining Detailed Computer Simulations and Experimental Data," NNSA, Washington D.C., March 2004.

Higdon, D.M., B.J. Williams, L.M. Moore, M. McKay, and S. Keller-McNulty, "Uncertainty Quantification for Combining Experimental Data and Computer Simulations," *Proceedings of the Foundations '04: A Workshop for VV&A in the 21st Century*. Taken from the keynote lecture by S. Keller-McNulty at the Foundations '04 Workshop, Tempe, Arizona.

Higdon, D.M., B. Williams, and L.M. Moore, "Calibration and Uncertainty Quantification Using Multivariate Simulator Output" (*ISBA World Meeting,* Viña del Mar, Chile, May 23–27, 2004).

Jackson, P.J., K.K. Hill, C.H. Helma, L.O. Ticknor, and R.T. Okinaka, "Phylogenetic Analyses of B. Anthracis and its Close Relatives – Similarities and Differences" (Bacterial Spores: Challenges and Future Directions for Biodefense, Argonne National Laboratory, Argonne IL, November 2004).

Kindinger, J.P., "Programmatic Risk-Overview of Methods for Decision Making & Risk Management (OUO)" (Risk Acceptance Seminar, July 2004).

Koehler, A., B. Sims, and R. Klamann, "GROMIT: A Tool for System Behavioral Modeling" (*Annual Meeting of the Society for Social Studies of Science,* Paris, France, August 25–28, 2004).

Koehler, A., J. Gonzales-Lujan, G. Tompkins, R. Burnside, and K. Lier, "Lessons and Challenges from Process Block-Flow to Immersive 3D Simulation" (Summer Computer Simulation Conference, San Jose, CA, July 25–29, 2004).

Lao, K., J. Bremser, M. Koby, J. Guzik, and J.R. Wendelberger, "The Development of New LiH and Lid Material Specifications" (Los Alamos National Laboratory, JOWOG 28, Y12 National Security Complex, Oak Ridge, Tennessee, June 2004).

Li, T.K., S.Y. Lee, K.E. Thomas, T.L. Burr, and H.O. Menlove (Los Alamos National Laboratory) and H.D. Kim, W.I. Ko, S.W. Park, and H.S. Park (Korea Atomic Energy Research Institute), "Safeguardability of Advance Spent Fuel Conditioning Process" (Presented at the 2004 Annual Institute of Nuclear Material Management [INMM] Meeting, Orlando, Florida, July 18–22, 2004).

Liang, L., C.M. Anderson-Cook, and T.J. Robinson, "Three-Dimensional Variance Dispersion Graphs for Designs with Split-Plot Structure" (Contributed Talk at Joint Statistical Meetings of the American Statistical Association, Toronto, Canada, August 12–14, 2004).

McKay, M.D., "Introduction to Statistical Methods for Understanding Prediction Uncertainty in Simulation Models" (6^{th} International Topical Meeting on Nuclear Reactor Thermal Hydraulics, Operations and Safety, Nara, Japan, October 4–8, 2004).

McKinney, G.W., J.W. Durkee, Jr., J.S. Hendricks, M.R. James, D.B. Pelowitz, and L.S. Waters, "MCNPX 2.5.0 - New Features Demonstrated" (submitted to the Monte Carlo 2005 Meeting, Chattanooga, TN, April 17–21, 2005).

McKinney, G.W., J.S. Hendricks, H.R. Trellue, and L.S. Waters, "Eigenfunction Convergence and Transmutation Enhancements in MCNPX" (submitted to PHYSOR-2004, American Nuclear Society Topical Meeting, Reactor Physics Division, Chicago, IL, April 25–29, 2004).

McPherson, T.M., M. Brown, and S. Burian, "Evaluation of the Accuracy of National Landuse Datasets for the Development of Urban Canopy Parameterizations" (5^{th} AMS Symposium on the Urban Environment, Vancouver, B.C., August 23–27, 2004).

McPherson, T.M., A. Ivey, G.E. Streit, and M.J. Brown, "Determination of the Spatial and Temporal Distribution of Population for Air Toxics Exposure Assessments" (5^{th} AMS Symposium on the Urban Environment, Vancouver, B.C., August 23–27, 2004).

Moore, L.M., M.D. McKay, and K. Campbell, "Combined Array Experiment Design" (Poster at 4^{th} International Conference on Sensitivity Analysis of Model Output [SAMO], Santa Fe, NM, March 8–11, 2004).

Morris, M., L.M. Moore, and M. McKay, "Input Uncertainty and Potential-to-Validate: Sampling Plans for Monte Carlo Assessment" (Foundations '04: A Workshop for VV&A in the 21^{st} Century, Phoenix, AZ, October 2004).

Michalak, S.E., K. Harris, N. Hengartner, B. Takala, and S. Wender, "Using the LANSCE IrradiationFacility to Predict the Weekly Number of Soft Errors in One of the World's Fastest Supercomputers" (Proceedings of the 18^{th} International Conference on Applications of Accelerators in Research and Industry, October 10–15, 2004).

Michalak, S.E., N. Hengartner, B. Takala, and S. Wender, "Accelerated Testing Methodology for Predicting Cosmic Ray Neutron-Induced Soft Errors" (Joint Statistical Meetings of the American Statistical Association, Toronto, Canada, August 12–14, 2004).

Moore, L.M., and J.R. Wendelberger, "Experiment Planning for a Materials Compatibility Study" (Invited presentation by L. Moore, 4th International Conference on Mathematical Methods in Reliability, Santa Fe, NM, June 21–25, 2004).

Nelson, M., M. Brown, E. Pardyjak, and J. Klewicki, "Turbulence Within and Above Real and Artificial Urban Canopies" (5^{th} AMS Symposium on the Urban Environment, Vancouver, B.C., Canada, August 23–27, 2004).

"NISAC and CIP/DSS Consequence Assessments," Presentation to Parney Albright, Assistant Secretary of the Office of Programs, Plans, and Budgets, Science & Technology Directorate, U.S. Department of Homeland Security, Los Alamos National Laboratory, Los Alamos, NM, November 18, 2004.

Ozol-Godfrey, A., C.M. Anderson-Cook, and E.L. Boone, "Assessing Designs for Mixture Experiments for the Generalized Linear Model Case" (Contributed Talk at Joint Statistical Meetings of the American Statistical Association, Toronto, Canada, August 12–14, 2004).

Park, Y.J., D. Richardson, A. Ozol-Godfrey, C.M. Borror, C.M. Anderson-Cook, and D.C. Montgomery, "Evaluating Experimental Designs for Cuboidal Regions" (Fall Technical Conference, Roanoke, VA, October 12–16, 2004).

Quirk, M.D., "Optimality on Compact Sets of Filter Banks" (Invited speaker at American Mathematical Society special session on Multiscale Methods and Sampling, Albuquerque, NM, October 16, 2004).

Quirk, M.D., and C. Brislawn, "Existence of Paraunitary Optimal Perfect Reconstruction Filter Banks" (IEEE 11th Digital Signal Processing Workshop, Taos, NM, August 1–4, 2004).

Reese, C.S., V. Johnson, M. Hamada, and A. Wilson, "A Hierarchical Model for System Reliability Based on Lifetime Data" (Mathematical Methods in Reliability Conference, Santa Fe, NM, June 21–25, 2004).

Riggs, T., M.D. Quirk, F. Roach, and G.L. Toole, "Customizing GIS for Critical Infrastructure" (Poster presented at ESRI User Conference, San Diego, CA, August 9–13, 2004). Received third place for Best Analytical presentation.

Salvatores, M., J.P. Groullier, E.A. Schneider, et al., "Partitioning and Transmutation Potential for Waste Minimization in a Regional Context" (8th International Information Exchange Meeting on Partitioning and Transmutation, Las Vegas, NV, November 9–11, 2004).

Sampson, T.E., T.L. Burr, and D.T. Vo, "Error Analysis of FRAM Gamma Ray Isotopic Analysis Data" (Institute Nuclear Materials Management [INMM] Meeting, Orlando, FL, July 18–22, 2004).

Tandon, L., J. Eglin, S. Michalak, R. Picard, D. Temer, and D. Jackson, "Plutonium Metal Exchange Program: Current Status and Statistical Analysis" (Proceedings of the 45th Institute of Nuclear Materials Management Meeting, Orlando, FL, July 18–22, 2004).

Ticknor, L.O., K.K. Hill, C.H. Helma, and P.J. Jackson, "Analysis of Amplified Fragment Length Polymorphisms Genomic Data for Identification of Clinical and Environmental Isolates" (Invited paper: 2004 WNAR/IMS meeting, Albuquerque NM, June 27–30, 2004).

Ticknor, L.O., K.K. Hill, C.H. Helma, and P.J. Jackson, "Analysis of AFLP Data for Molecular Identification of *Bacillus sp.*" (Invited talk: Lawrence Berkeley National Laboratory, Berkeley, CA, September 2004).

Trellue, H.R., and G.W. McKinney, "Burnup Capability Added to MCNPX" (2005 ANS Annual Meeting, San Diego, CA, June 5–9, 2005).

Velugubantla, S., S. Burian, M. Brown, W. Han, A. McKinnon, and T. McPherson, "Assessment of Methods for Creating a National Building Statistics Database for Atmospheric Dispersion Modeling" (5th AMS Symposium on the Urban Environment, Vancouver, B.C., August 23–27, 2004).

Wendelberger, J.R., "Designing an Aging Study" (Abstract of paper for Invited Session on Case Studies, to be presented at the 2005 Joint Statistical Meetings in Minneapolis, MN, August 7–11, 2005).

Wendelberger, J.R., and L.M. Moore, "Experiment Design in the Presence of Restricted Factor Combinations and Resource Constraints" (Joint Statistical Meetings of the American Statistical Association, Toronto, Canada, August 12–14, 2004).

Wendelberger, J.R., "Statistical Design and Analysis Techniques for Materials Testing and Development" (Paper selected for presentation at the Fall Technical Conference, Roanoke, VA, October 12–16, 2004).

Wendelberger, J.R., and L.M. Moore, "Experiment Design in the Presence of Restricted Factor Combinations and Resource Constraints" (Invited presentation, Spring Research Conference, Gaithersburg, MD, May 19–21, 2004).

Williams, M., M. Brown, D. Boswell, B. Singh, and E. Pardyjak, "Testing of the QUIC-PLUME Model with Wind-Tunnel Measurements for a High-Rise Building" (5th AMS Symposium on the Urban Environment, Vancouver, B.C., August 23–27, 2004).

Wilson, A.G., "Techniques for Test Design in the Context of Staged Acquisition" (NRC Workshop on Spiral Acquisition, Washington, D.C.).

Wilson, A.G., and K. Sentz, "An Overview of Uncertainty in the V&V Context" (Foundations 2004: A V&V Workshop, Phoenix, AZ, October 2004).

Wilson, A.G., "Predicting Operational Reliability with Quantified Confidence from Limited System Data. Putting the E in T&E" (International Test and Evaluation Association, Baltimore, MD, October 5, 2004).

Wilson, A.G., "Statistics and Big Science" (National Youth Science Camp, Bartow, WV, July 2004).

Wilson, A.G., and N. Hengartner, "Stockpile Reliability Assessment" (*ISBA World Meeting,* Viña del Mar, Chile, May 23–27, 2004).

Wilson, G.D., "The Intersection of the Humanities and Social Sciences with Big Science" (Seminar at the New Mexico Institute of Mining and Technology, Humanities Department, November 2004).

Wilson, G.D., and C. Herndl, "Fostering Collaboration in Socially Complex Problem Areas: A Rhetorical View" (The 28th Annual Meeting of the Society for the Social Studies of Science, Paris, France, August 2004).

Wilson, G.D., "The Social Lives of Scientific Facts" (National Youth Science Camp, Bartow, WV, July 2004).

Yeager, C.M., C.C. Grow, L.O. Ticknor, R. Cary, J.A. Pannucci, E.P. Williams, T.S. Brettin, and C.R. Kuske, "Modulation of *Bacillus anthracis* Transcriptome by Carbon Dioxide" (American Society of Microbiology Annual Meeting, New Orleans, LA, May 23–27, 2004).

Internal Reports

Adams, K.J., "Electron Upgrade for MCNP4B," Los Alamos National Laboratory document LA-UR-04-1399.

Amiri, B.W., and D.I. Poston, "Effect of Neutron Absorbers Mixed in or Coating the Fuel of a 1-MWt Lithium-Cooled Space Reactor," Los Alamos National Laboratory document LA-UR-04-7650.

Anderson-Cook, C.M., "Book Review of *Experimental and Quasi-Experimental Designs for Generalized Causal Inference,*" Los Alamos National Laboratory document LA-UR-04-7885.

Anderson-Cook, C.M., A. Ozol-Godfrey, and R.H. Myers, “Graphical Methods for Design Assessment for Designs Involving Generalized Linear Models,” Los Alamos National Laboratory document LA-UR-04-5155.

Anderson-Cook, C.M., “Book Review of *Statistical Methods for Six Sigma in R&D and Manufacturing*,” Los Alamos National Laboratory document LA-UR-04-5305.

Anderson-Cook, C.M., “Book Review of *Common Errors in Statistics (and How to Avoid Them)*,” Los Alamos National Laboratory document LA-UR-04-5308.

Anderson-Cook, C.M., “Book Review of *System Reliability Theory: Models, Statistical Methods, and Applications*,” Los Alamos National Laboratory document LA-UR-04-5309.

Anderson-Cook, C.M., “Book Review of *A Primer on Statistical Distributions*,” Los Alamos National Laboratory document LA-UR-04-5310.

Anderson-Cook, C.M., “Book Review of *Web Development of SAS by Example*,” Los Alamos National Laboratory document LA-UR-04-5933.

Anderson-Cook, C.M., “Beyond Just Sample Size – Issues to Consider when Selecting a Design,” Los Alamos National Laboratory document LA-UR-04-6480.

Anderson-Cook, C.M., L. Liang, and T.J. Robinson, “Graphical Design Assessment Tools for Split-Plot Designs,” Los Alamos National Laboratory document LA-UR-04-7083.

Anderson-Cook, C.M., L. Liang, and T.J. Robinson, “Graphical Design Assessment Tools for Split-Plot Designs,” Los Alamos National Laboratory document LA-UR-04-5158.

Anderson-Cook, C.M., and A. Ozol-Godfrey, “Using Fraction of Design Space Plots for Informative Comparisons between Designs,” Los Alamos National Laboratory document LA-UR-04-5152.

Anderson-Cook, C.M., A. Patterson, and R. Hoerl, “A Structured Problem Solving Course for Graduate Students: Exposing Students to Six Sigma as Part of their University Training,” Los Alamos National Laboratory document LA-UR-04-5306.

Anderson-Cook, C.M., A.G. Wilson, A.C. Koehler, T.L. Graves, and C. Chiu, “Integrated Reliability Assessment,” Los Alamos National Laboratory document LA-UR-04-6733.

Bathke, C.G., and E.A. Schneider, “NFCSim User’s Manual,” Los Alamos National Laboratory document LA-UR-04-8369 (November 2004).

Becker, N., L. Bettencourt, W. Buehring, W. Beyeler, T. Brown, B. Bush, S. Conrad, L. Dauelsberg, S. DeLand, C. Joslyn, P. Kaplan, R. LeClaire, V. Loose, M. North, D. Powell, S. Rasmussen, K. Saeger, M. Samsa, D. Thompson, R. Whitfield, and M. Witkowski, “Guidelines for Determining CIP/DSS Infrastructure Model Depth and Breadth Requirements,” Los Alamos National Laboratory document LA-UR-04-5324 (2004).

Becker, N., W. Buehring, W. Beyeler, T. Brown, B. Bush, S. Conrad, L. Dauelsberg, S. DeLand, M. Ebinger, S. Folga, G. Hirsch, P. Kaplan, J. Kavicky, V. Koritarov, R. LeClaire, Z. Li, V. Loose, M. McLamore, D. Newsom, E. Portante, D. Powell, S. Rasmussen, K. Saeger, D. Sallach, M. Samsa, S. Shamsuddin, J. St. Aubin, D. Thompson, R. Whitfield, and M. Witkowski, “CIP/DSS Gap Analysis,” Los Alamos National Laboratory document LA-UR-04-5320 (2004).

Becker, N., and B. Bush, “Metropolitan CIP/DSS Key Resources Sector Model,” Los Alamos National Laboratory document LA-UR-04-5314 (2004).

Bell, C.R., A.V. Belooussov, J.E. Boudreau, W.L. Kubic, Jr., and F.J. Martin, “The United States Preoperational-Phase Safety Analysis and Evaluation Report for the Russian Fissile Material Storage Facility,” Los Alamos National Laboratory document LA-CP-04-0185.

Belooussov, A.V., “Preoperational-Phase Verification Report for Russian Fissile Material Storage Facility Evacuation Procedures,” Los Alamos National Laboratory Document LA-CP-04-0041.

Belooussov, A.V., “Russian Fissile Material Storage Facility Safety Readiness Verification Report,” Los Alamos National Laboratory document LA-CP-04-0042.

Belooussov, A.V., and J.E. Boudreau, “Training Evaluation Report for the Russian Fissile Material Storage Facility,” Los Alamos National Laboratory document LA-CP-04-0211.

Belooussov, A.V., and J.E. Boudreau, “Preoperational-Phase Testing Evaluation Report for the Russian Fissile Material Storage Facility,” Los Alamos National Laboratory document LA-CP-04-0212.

Belooussov, A.V., “Preoperational-Phase Verification Report for Radiation Safety System Operation,” Los Alamos National Laboratory document LA-CP-04-0213.

Belooussov, A.V., and J.E. Boudreau, “Maintenance Evaluation Report for the Russian Fissile Material Storage Facility,” Los Alamos National Laboratory document LA-CP-04-0214.

Belooussov, A.V., and J.E. Boudreau, “Radiation Protection Evaluation Report for the Russian Fissile Material Storage Facility,” Los Alamos National Laboratory document LA-CP-04-0215.

Belooussov, A.V., and J.E. Boudreau, “Conduct of Operations Evaluation Report for the Russian Fissile Material Storage Facility,” Los Alamos National Laboratory document LA-CP-04-0208.

Belooussov, A.V., “Preoperational-Phase Verification Report on Reloader Exhaust Filter Operational Procedures,” Los Alamos National Laboratory Document LA-CP-04-0209.

Belooussov, A.V., “Preoperational-Phase Verification Report on Nest Lid Closing Procedures,” Los Alamos National Laboratory document LA-CP-04-0210.

Belooussov, A.V., “Bilibino Nuclear Power Plant Description Report,” Los Alamos National Laboratory document LA-CP-04-0413.

Belooussov, A.V., “Russian Nuclear Power Plants with VVER Reactors,” Los Alamos National Laboratory document LA-CP-04-0473.

Belooussov, A.V., “Modernized Nuclear Water-Water Research Reactor (WWR-SM), Uzbekistan,” Los Alamos National Laboratory document LA-CP-04-0592.

Belooussov, A.V., “Kazakhstan’s Nuclear Reactors,” Los Alamos National Laboratory document LA-CP-04-0639.

Belooussov, A.V., “Technical Opinion on the Russian Safety Analysis Report for the Central Fissile Material Storage Facility,” Los Alamos National Laboratory document LA-CP-04-0714.

Belooussov, A.V., “Russian Nuclear Icebreakers,” Los Alamos National Laboratory document LA-CP-04-0732.

Belooussov, A.V., “Russian Research Nuclear Reactors,” Los Alamos National Laboratory document LA-CP-04-0862.

Belooussov, A.V., “Bushehr Nuclear Power Plant Description Report,” Los Alamos National Laboratory document LA-CP-04-0930.

Belooussov, A.V., “Russian Nuclear Submarines,” Los Alamos National Laboratory document LA-CP-05- (in Classification review).

Blue, M.P., and B.W. Bush, “Critical Energy Infrastructure Contingency Screening Heuristics Status Report,” Los Alamos National Laboratory document LA-UR-04-7649 (2004).

Bott, T.F., and S.W. Eisenhawer, “Susceptibility and Vulnerability Models for Terrorist Attacks,” Los Alamos National Laboratory document LA-UR-04-0140.

Bott, T.F., and S.W. Eisenhawer, “A Structured Approach to Resource Allocation,” Los Alamos National Laboratory document LA-UR-04-1398.

Bott, T.F., and S.W. Eisenhawer, “Logic-Evolved Decision Applications to Security,” Los Alamos National Laboratory document LA-UR-04-1397.

Bott, T.F., S.W. Eisenhawer, K. Sasser, and S. Fischer, “A Demonstration of Attractiveness Ordering of Terrorist Attack Scenarios Using Logic-Evolved Decision (LED) Analysis (U),” Los Alamos National Laboratory document LA-CP-04-0487.

Bott, T.F., S.W. Eisenhawer, S. Donald, and G. Chavez, “Using Logic-Gate Trees to Generate, Organize, and Store Scenarios,” Los Alamos National Laboratory document LA-UR-04-3375.

Bott, T.F., and S.W. Eisenhawer, “A Structured Approach to Resource Allocation,” Los Alamos National Laboratory document LA-UR-04-4248.

Bott, T.F., and S.W. Eisenhawer, “Development of Optimal Lightning Warning Procedures Using Probabilistic Risk Assessment,” Los Alamos National Laboratory document LA-UR-04-5328.

Bott, T.F., and S.W. Eisenhawer, “Development of Optimal Lightning Warning Procedures Using Probabilistic Risk Analysis (Paper),” Los Alamos National Laboratory document LA-UR-04-8130.

Bott, T.F., and S.W. Eisenhawer, “Development of Optimal Lightning Warning Procedures Using Probabilistic Risk Assessment,” Los Alamos National Laboratory document LA-UR-04-8842.

Bozwell, D., and M. Brown, “QUIC Quick Start Guide, v. 3.1,” Los Alamos National Laboratory document LA-UR-04-5275, 57 pp. (2004).

Brown, M., S. Linger, T. McPherson, G. Streit, and M. Williams, “Reconstruction of Airborne Biological Agent Events: The Houston incidents, October 2003,” Los Alamos National Laboratory document LA-CP-04-0004, 45 pp. (2004).

Brown, T., B. Bush, S. DeLand, D. Powell, and M. Samsa, “Guidelines for Determining CIP/DSS Infrastructure Model Depth and Breadth Requirements,” Los Alamos National Laboratory document LA-UR-04-5324 (August 2004).

Brown, T., B. Bush, S. DeLand, D. Powell, and M. Samsa, “CIP/DSS Gap Analysis,” Los Alamos National Laboratory document LA-UR-04-5325 (August 2004).

Brown, T., B. Bush, S. DeLand, and D. Powell, “CIP/DSS Model Development Plan,” Los Alamos National Laboratory document LA-UR-04-6147 (September 2004).

Burr, T., and G. H. Tompkins, “Background Suppression Issues,” Los Alamos National Laboratory document LA-UR-04-5577 (August 2004).

Burr, T.L., “Performance of Variable Selection Methods in Regression using Variations of the Bayesian Information Criterion,” Los Alamos National Laboratory document LA-UR-04-6324, draft undergoing internal peer review (2004).

Bush, B.W., “NISAC Interdependent Energy Infrastructure Simulation System,” Los Alamos National Laboratory document LA-UR-04-7700 (2004).

Bush, B., “Metropolitan CIP/DSS Energy Sector Model,” Los Alamos National Laboratory document LA-UR-04-5322 (2004).

Bush, B., S. DeLand, and M. Samsa, “Critical Infrastructure Protection Decision Support System (CIP/DSS) Project Overview,” Los Alamos National Laboratory document LA-UR-04-5319 (2004).

Campbell, K., L.M. Moore, M.D. McKay, and V. Thomas, “Boost Sensitivity Studies (U),” Los Alamos National Laboratory document LA-CP-04-0272.

Campbell, K., L.M. Moore, M. D. McKay, and V. Thomas, “Sensitivity Studies Applied to Boost (U),” Los Alamos National Laboratory document LA-CP-04-0304.

Campbell, K., “Statistical Model Calibration,” Los Alamos National Laboratory document LA-UR-04-0001

Campbell, K., “Statistical Calibration of Computer Simulations,” Los Alamos National Laboratory document LA-UR-04-1308.

Choi, M.M., T.J. Farish, and V.P. Worland, “Evaluation of the Current Capacity of the Los Alamos National Laboratory’s Radioactive Liquid Waste Treatment Facility and Recommendations for Its Future Design,” Los Alamos National

Laboratory document LA-UR-04-7834 (November 2004).

Dale, C.B., "1. Documentation of Completed Reactor Studies: Material Properties (Task 1)," Los Alamos National Laboratory document LA-CP-04-0741.

Dale, C.B., "Work Item 1. Documentation of Completed Reactor Studies. Documentation of the Detailed Design Assumptions and Methodologies Used in the Feasibility Studies," Los Alamos National Laboratory document LA-CP-04-0938.

Darby, J.L., "Network Sensor Project, Interim Report," Los Alamos National Laboratory document LA-UR-04-7013 (September 2004).

Darby, J.L., and D.A. O'Brien, "Top Level Architecture for Future Security of the Air Transportation System," Los Alamos National Laboratory document LA-CP-04-0819 (October 2004).

Darby, J.L., "Estimating Terrorist Risk with Possibility Theory," Los Alamos National Laboratory report LA-14179 (November 2004).

Ding, M., A. Abdel-Fattah, S. Fischer, B. Letellier, K. Howe, J. Garcia, and C. Shaffer, "Characterization of Latent Debris from Pressurized-Water-Reactor Containment Buildings," Los Alamos National Laboratory document LA-UR-04-3970.

Donald, S., T.F. Bott, and S.W. Eisenhawer, "Representing Subjective Knowledge in Engineering Systems using Possibility Trees," Los Alamos National Laboratory document LA-UR-04-2149.

Donald, S., "Representing Subjective Knowledge in Engineering Systems Using Possibility Trees," Los Alamos National Laboratory document LA-UR-04-4870.

Dworzak, W., E. Kelly, O. Gillespie, and P. Bielenberg, "Large Scale Stabilization Studies," Los Alamos National Laboratory document LA-UR-04-3398 (May 2004).

Durkee, J.W., "LANL LDRD MCNPX Magnetic Field Code Development," Los Alamos National Laboratory document LA-UR-04-6557.

Edelmann, P.G., "Determination and Assessment of Graded Safeguards Category and Attractiveness Level for Lower-Enrichment JIMO Nuclear Reactor Fuel Material: Task 2," Los Alamos National Laboratory document LA-CP-04-0713.

Edelmann, P.G., "Determination and Assessment of Graded Safeguards Categories for Potential Space Reactor Fuels," Los Alamos National Laboratory document LA-UR-04-7059.

Edelmann, P.G., "A Methodology for Reliability-Based Design of a Heat Pipe Space Power Reactor," Los Alamos National Laboratory document LA-CP-05-0045.

Eisenhawer, S.W., and T.F. Bott, "A Risk-Based Prioritization of Research for Aviation Security Using Logic-Evolved Decision Analysis," Los Alamos National Laboratory document LA-UR-04-0455.

Eisenhawer, S.W., and T.F. Bott, "Risk Analysis of Intentional Attacks," Los Alamos National Laboratory document LA-UR-04-0836.

Eisenhawer, S.W., T.F. Bott, M.R. Sorokach, F.P. Jones, and J.R. Foggia, "Risk-Based Prioritization of Research for Aviation Security Using Logic-Evolved Decision Analysis," Los Alamos National Laboratory document LA-UR-04-2879.

Eisenhawer, S.W., T.F. Bott, and S. Donald, "Performance Analysis of the Lightning Warning and Protection System at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-04-3465.

Eisenhawer, S.W., T.F. Bott, C.R. Odom, and W.H. Beasley, "Analysis of Operational Data from the Lightning Detection and Warning System at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-04-5460.

Eisenhawer, S.W., T.F. Bott, and S. Donald, "Performance Analysis of the Lightning Warning and Protection System at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-04-6405.

Evans, K.J., and D.S. DeCroix, "Improved Bulk Microphysics Scheme for Use in Cloud Models with a Nonlinear Navier-Stokes Equation Set," Los Alamos National Laboratory document LA-UR-04-5634.

Fearey, B.L., P.C. White, J. St. Ledger, and J.D. Immele, "The Effects of Nuclear Earth Penetrating Weapons," Los Alamos National Laboratory document LA-UR-04-3606 (2004).

Fearey, B.L., and J. St. Ledger, "Nuclear Effects Summary," Los Alamos National Laboratory document LA-UR-04-2618 (April 2004).

Fensin, M.L., and D.I. Poston, "Optimum Critical Reflector Configurations for Minimizing Fission Power Peaking in a Lithium-Cooled, Liquid-Metal Space Reactor," Los Alamos National Laboratory document LA-UR-04-7154.

Finch, J.P., J.S. Hendricks, and C. Choi, "Correct Source Distributions in Monte Carlo Criticality Calculations," Los Alamos National Laboratory document LA-UR-04-4953.

Flores, E.M., "Task 3; Activity 2: Stress Analysis for Redesigned Reactor to Brayton Ducting," Los Alamos National Laboratory document LA-CP-04-0754.

Flores, E.M., "Task 3, Activity 1: Stress and Creep Strain Analysis for Heat Pipe Reactor Core," Los Alamos National Laboratory document LA-CP-04-0755.

Flores, E.M., "Task 3: Liquid Metal Vessel Creep Analysis," Los Alamos National Laboratory document LA-CP-04-0756.

Gauntt, R.O., S. Ashbaugh, and C.G. Tinkler, "Mitigation of Radioactive Releases from a Damaged Nuclear Power Plant," Los Alamos National Laboratory document LA-CP-04-0571.

Gilmore, W.E., and J. Brewer, "Review of Interactive Electronic Procedure Classroom Training," Los Alamos National Laboratory document LA-UR-04-0824.

Gilmore, W.E., and J. Brewer, "Review of the User-System Interface for the

Pantex Interactive Electronic Procedures (IEPs): Status of Previous Findings and Recommendations," Los Alamos National Laboratory document LA-UR-04-1943.

Gilmore, W.E., "Interactive Electronic Procedures: NES Master Study," Los Alamos National Laboratory document LA-UR-04-9084.

Goldfarb, H.B., C.M. Borror, D.C. Montgomery, and C.M. Anderson-Cook, "Using Genetic Algorithms to Generate Statistical Designs for Mixture-Process Variable Experiments with Control and Noise Variables," Los Alamos National Laboratory document LA-UR-04-7485.

Graves, T.L., and M.S. Hamada, "Making Inferences with Indirect Measurements," Los Alamos National Laboratory document LA-UR-03-7367.

Graves, T.L., and M.S. Hamada, "Bayesian Methods for Assessing System Reliability: Models and Computation," Los Alamos National Laboratory document LA-UR-04-6834.

Graves, T.L., and M.S. Hamada, "Combining Multi-Level Data to Assess System Reliability and Allocate Resources Optimally: Bayesian Methods and Computation," Los Alamos National Laboratory document LA-UR-04-7157.

Graves, T.L., P.L. Speckman, and D. Sun, "Characterizing and Eradicating Autocorrelation in MCMC Algorithms for Linear Models," Los Alamos National Laboratory document LA-UR-04-0486.

Greitzer, F.L., D.J. Pond, and M. Jannotta, "Scenario-Based Training on Human Errors Contributing to Security Incidents," Los Alamos National Laboratory document LA-UR-04-4124.

Greitzer, F.L., D.J. Pond, and M. Jannotta, "Scenario-Based Training on Human Errors Contributing to Security Incidents (Viewgraphs)," Los Alamos National Laboratory document LA-UR-04-6406.

Hemphill, G.M., "Deriving Measurement Uncertainties from the Remeasurement Database," Los Alamos National Laboratory document LA-UR-04-8630.

Houts, M.G., D.I. Poston, and R.J. Kapernick, "Near-Term Fission Power Systems for Asteroid Deflection Missions," Los Alamos National Laboratory document LA-UR-04-1178.

Howe, K., J. Garcia, B.C. Letellier, and J. Dallman, "Integrated Chemical Effects Testing (ICET): Interim Report for Test 1," Los Alamos National Laboratory document LA-UR-05-0124.

James, M.R., G.W. McKinney, and L.S. Waters, "Transport of Heavy Ions in MCPNX," Los Alamos National Laboratory document LA-UR-04-5870.

Joslyn, C., and D. Powell, "Critical Infrastructure Protection Decision Support System (CIP/DSS): Addressing Uncertainty and Risk," Los Alamos National Laboratory document LA-UR-04-6720 (September 2004).

Kelly, E., J. McClard, L. Peppers, J. Stakebake, and T. Venetz, "3013 Surveillance Sampling The Statistical Sample," Los Alamos National Laboratory document LA-UR-04-6441 (October 2004).

Key, B.P., "Application of Logic Models in Representing the Behavior of High Explosives in a Cookoff Environment," Los Alamos National Laboratory document LA-UR-04-7953.

Kim, K.S., "Accident Analysis for Nuclear Environmental Sites at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-04-3814.

Kindinger, J.P., "Programmatic Risk—Overview of Methods for Decision Making & Risk Management," Los Alamos National Laboratory document LA-CP-04-0626.

Kindinger, J.P., "Escaping the Compliance Trap," Los Alamos National Laboratory document LA-UR-04-7998.

Knight, E.E., M.B. Cline, W.B. Daniel, J. St. Ledger, S. Mortenson, and K.M. Omberg, "BioNet Area Monitoring Task: Evaluation Measures for Selected BioDetection Technologies," Los Alamos National Laboratory document LA-UR-04-7501 (October 2004).

Knight, E.E., D. Redman, and K.M. Omberg, "Technician Questionnaire for Selected BioDetection Technologies," Los Alamos National Laboratory document LA-UR-04-7502 (October 2004).

Kornreich, D.E., and R.F. Farman, "Risk Analysis for Development and Production of the 4T Gas Transfer System (U)," Los Alamos National Laboratory document LA-CP-04-0079 (January 2004).

Kubic, W.L., Jr., "An Inorganic Route to Liquid Fuels and Petrochemicals," Los Alamos National Laboratory document LA-UR-04-7901.

Kubic, W.L., Jr., "Beyond Petroleum: An Inorganic Route to Liquid Transportation Fuels," Los Alamos National Laboratory document LA-UR-04-7902.

Kubic, W.L., Jr., "The Synergy between Productivity and Safety," Los Alamos National Laboratory document LA-UR-04-8115.

Kubic, W.L., Jr., "Los Alamos National Laboratory's Perspective on Corrosion," Los Alamos National Laboratory document LA-UR-04-8515.

Kubic, W.L., Jr., "Preoperational-Phase Verification of the Reliability of the Hermetic Barriers in the AT-400R Container," Los Alamos National Laboratory document LA-CP-04-0114.

Kubic, W.L., Jr., and J.E. Boudreau, "United States Evaluation of Environmental Releases from the Russian Fissile Material Storage Facility," Los Alamos National Laboratory document LA-CP-04-0240.

Kubic, W.L., Jr., and A.V. Belooussov, "A Summary of the United States Evaluation of Safety and Environmental Releases for the Russian Fissile Material Storage Facility," Los Alamos National Laboratory document LA-CP-04-0250.

Kubic, W.L., Jr., "Preoperational-Phase Verification of Fire Safety Provisions," Los Alamos National Laboratory document LA-CP-04-0207.

Kubic, W.L., Jr., "Notes on Electronic Systems in an Urban-Marine

Environment," Los Alamos National Laboratory document LA-CP-05-0002.
Kubic, W.L., Jr., "LANL 2004 Version of SCINFUL—A Monte-Carlo-Based Computer Code to Determine a Scintillator Full-Energy Response to Neutron Detection for En between 0.1 and 80 MeV," Los Alamos National Laboratory document LA-UR-04-5550.
Lee, J.H., "Radiation Detection Systems: The Second Line of Defense (SLD) Team at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-04-6176.
Leonard, M.T., and S.G. Ashbaugh, "Coolant Delivery Requirements for a Generic BWR/4 Mark I Mitigation System," Los Alamos National Laboratory document LA-CP-04-0645.
Letellier, B.C., C.B. Dale, A. Maji, K. Howe, and F. Carles, "Screen Penetration Test Report," Los Alamos National Laboratory document LA-UR-04-5416.
Li, T., T.L. Burr, and H. Menlove, "Safeguardability of the Advanced Spent Fuel Conditioning Process," Los Alamos National Laboratory document LA-UR-04-0514.
Li, T., M. Miller, H. Menlove, T. Wenz, J. Franco, C. Rael, J. Doak, H. Joseph, K. Thomas, and T.L. Burr (large funded effort by Burr), "Safeguards Systems Study for the Japanese MOX Fuel Fabrication Plant (JMOX)," Los Alamos National Laboratory document LA-CP-03-0959 (April 2004).
Liang, L., C.M. Anderson-Cook, and T.J. Robinson, "Three-Dimensional Variance Dispersion Graphs for Designs with Split-Plot Structure," Los Alamos National Laboratory document LA-UR-04-5151.
Liang, L., C.M. Anderson-Cook, T.J. Robinson, and R.H. Myers, "Three-Dimensional Variance Dispersion Graphs and Optimizing Central Composite Design for Split-Plot Designs," Los Alamos National Laboratory document LA-UR-04-7486.
Liang, L., C.M. Anderson-Cook, T.J. Robinson, and R.H. Myers, "Three-Dimensional Variance Dispersion Graphs for Designs with Split-Plot Structure," Los Alamos National Laboratory document LA-UR-04-5934.
Luck, L.B., "Surety Modeling," Los Alamos National Laboratory document LA-CP-04-0236.
Maloy, S., M. James, S. Srivilliputhur, C. Deo, J. Stubbins, and M. Okuniewski, "Materials Modeling for the Advanced Fuel Cycle Initiative Program," Los Alamos National Laboratory document LA-UR-04-6355.
Marcille, T.F., "JIMO Cross-Section Work Update and Data Testing Results," Los Alamos National Laboratory document LA-UR-04-5461.
Marcille, T.F., and P.G. Edelmann, "JIMO Reactor Module: Critical Benchmark Experiment Review for Application to JIMO," Los Alamos National Laboratory document LA-CP-04-0706.
Marcille, T.F., and D.B. Pelowitz, "JIMO Reactor Module: MCNP(X) Code and Cross-Section Qualification Description Document," Los Alamos National Laboratory document LA-CP-04-0684.
Marcille, T.F., "4. Physics Qualification—JIMO Reactor Module: ZPPR-16 and ZPPR-20 Qualification Task [4.3 (Activity ID: A1430)]," Los Alamos National Laboratory document LA-CP-04-0723.
Marcille, T.F., "ZPPR-16 & 20 Benchmark Review and Assessment," Los Alamos National Laboratory document LA-UR-04-8114.
Marcille, T.F., "2. Design Team Participation, JIMO Reactor Module: Hydrodynamic Analysis," Los Alamos National Laboratory document LA-CP-04-0885.
McClard, C., E. Kelly, L. Peppers, J. Stakebake, and T. Venetz, "Binning of 3013 Items for Field Surveillance," Los Alamos National Laboratory document LA-UR-04-6144 (October 2004).
McClure, P.R., "Pushing the Envelope on Nuclear Reactor Accident Modeling," Los Alamos National Laboratory document LA-UR-04-1570.
McClure, P.R., R. LeClaire, and S.G. Ashbaugh, "Pressurized-Water-Reactor MELCOR Calculations for the United States Nuclear Regulatory Commission's Nuclear Power Plant Vulnerability Study," Los Alamos National Laboratory document LA-CP-04-0501.
McClure, P.R., and K. Sasser, "Radiological Risk Management and Acceptance," Los Alamos National Laboratory document LA-UR-04-4696.
McClure, P.R., and S. Ashbaugh, "Nuclear-Power-Plant Vulnerability Study: Pressurized-Water-Reactor Success Calculations in Support of Mitigation Strategies," Los Alamos National Laboratory document LA-CP-04-0646.
McClure, P.R., "Reactor Safety and Modeling Capabilities," Los Alamos National Laboratory document LA-UR-04-7832.
McClure, P.R., "NRC, DOE, and NASA Vulnerability Assessments," Los Alamos National Laboratory document LA-UR-04-8301.
McKay, M.D., and B.J. Williams, "Calibrated Prediction," Los Alamos National Laboratory document LA-UR-04-4245.
McKinney, G.W., and H.R. Trellue, "Transmutation Feature within MCNPX," Los Alamos National Laboratory document LA-UR-04-0837.
McKinney, G.W., J.S. Hendricks, H.R. Trellue, and L.S. Waters, "Eigenfunction Convergence and Transmutation Enhancements in MCNPX," Los Alamos National Laboratory document LA-UR-04-1228.
McKinney, G.W., and H.R. Trellue, "Transmutation Feature within MCNPX," Los Alamos National Laboratory document LA-UR-04-1572.
McKinney, G.W., J.S. Hendricks, H.R. Trellue, L.S. Waters, and F.X. Gallmeier, "MCNPX Capabilities Relevant to Active Interrogation Simulations," Los Alamos National Laboratory document LA-UR-04-4397.
McKinney, G.W., J.W. Durkee, J.S. Hendricks, M.R. James, D.B. Pelowitz, H.R. Trellue, et al., "MCNPX 2.5.0—New Features Demonstrated," Los

Alamos National Laboratory document LA-UR-04-5553.

Medina, P.M., and T.L. Norris, "Modern Pit Facility Technology Development Group Meeting, 18-20 May 2004," Los Alamos National Laboratory document LA-CP-04-0572 (OUO) (June 2004).

Michalak, S.E., "Estimation of the Expected Weekly Number of Soft Errors in QA or QB," Los Alamos National Laboratory document LA-UR-04-4697.

Michalak, S.E., and R. Gupta, "Crisis Negotiations Game Scenario," Los Alamos National Laboratory document LA-UR-04-1253.

Michalak, S.E., R. Picard, L. Tandon, and J. Eglin, "Statistical Analysis of Plutonium Metal Exchange Data," Los Alamos National Laboratory document LA-CP-04-0098.

Moya, J.L., and R.Y. Parker, "PF-4 Trolley System-Supplementary Information (UCNI)," Los Alamos National Laboratory document LA-CP-04-0533 (June 2004).

Norris, T.L., "Modern Pit Facility Technology Working Group FY03 Year End Report," Los Alamos National Laboratory document LA-CP-04-0565 (OUO) (June 2004).

Norris, T.L., and S. Venkatesh, "Modern Pit Facility Design Data Input Sheet Approval, Rev. 0 and Unresolved Issues (OUO)," Los Alamos National Laboratory document LA-CP-04-0621 (July 2004).

Ozol-Godfrey, A., C.M. Anderson-Cook, and E.L. Boone, "Assessing Designs for Mixture Experiments for the Generalized Linear Model Case," Los Alamos National Laboratory document LA-UR-04-5154.

Ozol-Godfrey, A., C.M. Anderson-Cook, and D.C. Montgomery, "Assessing Designs for Mixture Experiments for the Generalized Linear Model Case," Los Alamos National Laboratory document LA-UR-04-5153.

Ozol-Godfrey, A., C.M. Anderson-Cook, and R.H. Myers, "Graphical Methods for Design Assessment for Designs Involving Generalized Linear Models," Los Alamos National Laboratory document LA-UR-04-5157.

Park, Y.J., D. Richardson, A. Ozol-Godfrey, C.M. Borror, C.M. Anderson-Cook, and D.C. Montgomery, "Prediction Variance Properties of Second-Order Response Surface Designs for Cuboidal Regions," Los Alamos National Laboratory document LA-UR-04-5156.

Parker, R.Y., and R.F. Farman, "D-2 Extend Pu Model—Material Handling Assessment Summary," Los Alamos National Laboratory document LA-CP-04-0384 (OUO) (April 2004).

Palmer, M.J., P.M. Medina, and T.L. Norris, "Modern Pit Facility Process Flowsheets, Part 1, Revision 1," Los Alamos National Laboratory document LA-CP-04-0590 (OUO) (June 2004).

Pond, D.J., and D.B. Beach, "DX-Division CREM 1 Security Incident: ESTHER Causal Analysis and Corrective Action Recommendations," Los Alamos National Laboratory document LA-CP-04-0657.

Pond, D.J., "Co-Location of Weapons Disassembly Operations: Human Factors Considerations," Los Alamos National Laboratory document LA-UR-04-2880.

Pond, D.J., M. Jannotta, and M. Segura, "Security Incident Error Assessment and Reporting Workshop," Los Alamos National Laboratory document LA-UR-04-4691.

Pond, D.J., W.E. Gilmore, and L.R. Pond, "ESTHER Scan Results: FY2003 LANL Classified Media Security Incidents," Los Alamos National Laboratory document LA-CP-04-0667.

Pond, D.J., "Human Error Assessment and Security Incident Prevention," Los Alamos National Laboratory document LA-UR-04-7391.

Pond, D.J., and F. Greitzer, "Discovery-Based Cognitive Learning Principles for More Effective Cyber Security Training," Los Alamos National Laboratory document LA-UR-04-8910.

Pond, D.J., and F. Greitzer, "Eliminating Error-Based Security Incidents," Los Alamos National Laboratory document LA-UR-04-8966.

Pond, D.J., "Analyzing and Reducing Errors and Incidents," Los Alamos National Laboratory document LA-UR-05-0410.

Poston, D.I., R.J. Kapernick, M.G. Houts, C.B. Dale, J.H. Lee, Jr., et al., "Jupiter Icy Moons Orbiter Reactor Module Design and Development," Los Alamos National Laboratory document LA-CP-04-0341.

Poston, D.I., R.J. Kapernick, R.E. Lujan, B.J. Ade, B.W. Amiri, J.T. Fensin, et al., "Mass Impact of Safety Scenarios, Shutdown Margins, and Safety Approaches for a 2.4 MWt Lithium-Cooled Space Reactor Concept," Los Alamos National Laboratory document LA-CP-04-0660.

Poston, D.I., "A Comparison of Fast-Spectrum and Moderated Space Fission Reactors," Los Alamos National Laboratory document LA-UR-04-8131.

Poston, D.I., R.J. Kapernick, T.F. Marcille, P.G. Edelmann, and B.W. Amiri, "Jupiter Icy Moons Orbiter Reactor Module Conceptual Feasibility Report," Los Alamos National Laboratory document LA-UR-04-0882.

Powell, D., "Metropolitan Emergency Services Sector Model," Los Alamos National Laboratory document LA-UR-04-5725 (August 2004).

Powell, D., "Metropolitan Public Health Sector Model," Los Alamos National Laboratory document LA-UR-04-5725 (August 2004).

Powers, J.M., "Two-Phase Viscous Modeling of Compaction of Granular Materials," Los Alamos National Laboratory document LA-UR-04-1709.

Powers, J.M., "Two-Phase Viscous Modeling of Compaction of Granular (Energetic) Materials," Los Alamos National Laboratory document LA-UR-04-1976.

Quirk, M.D., K.J. Saeger, J.L. Darby, S.J. Fernandez, G.L. Toole, R.E. Michelsen, S.D. Matthews, and M.S. McNulty, "A Methodology for Estimating Robustness Across Infrastructure," Los Alamos National Laboratory document LA-UR 04-3910 (2004).

Rao, DV, “Proceedings of the NEA/NRC Workshop on Debris Impact on Emergency Coolant Recirculation,” Los Alamos National Laboratory document LA-UR-04-1018.

Richardson, J.A., D.J. Gordon, R.B. Tell, K.T. Kern, J.T. Romero, and M.J. Vigil, “Bounding Fire Accident for Los Alamos National Laboratory Plutonium Facility,” Los Alamos National Laboratory document LA-UR-04-3775 (June 2004).

Ritter, J.S., “W76-1/Mk4A LEP (Life Extension Plan) Rise Management (OUO),” Los Alamos National Laboratory document LA-CP-04-0507 (June 2004).

Ritter, J.S., and T.R. Hill, “Use of Level of Effort in Project Planning,” Los Alamos National Laboratory document LA-UR-04-4898 (July 2004).

Sadasivan, P., R.J. Kapernick, T.F. Marcille, R.S. Reid, G.L. Schmidt, and M.H. Horner, “Testing Plan for the Heat Pipe Reactor,” Los Alamos National Laboratory document LA-CP-04-0786.

Sanzo, S., “Extension of a Potential Flow Model for Rayleigh-Taylor and Richtmyer-Meshkov Instabilities for All Density Ratios to Include Spikes,” Los Alamos National Laboratory document LA-UR-04-4020.

Schneider, E.A., M. Salvatores, et al., “NFCSim Scenario Studies of German and European Reactor Fleets,” Los Alamos National Laboratory document LA-UR-04-4911 (July 2004).

Schneider, E.A., “Nuclear Data Uncertainty Analyses: Fuel Cycle Outcomes,” Los Alamos National Laboratory document LA-UR-04-6782 (October 2004).

Schneider, E.A., “Survey of Uranium Supply Curve Estimates,” Los Alamos National Laboratory document LA-UR-05-0173 (January 2005).

Schneider, E.A., “On the Cost Impact of Delaying the AFCI Separations Facility,” Los Alamos National Laboratory document LA-UR-05-0174 (January 2005).

Schuller, M., C. Kurwitz, and R. Williams, “Mars Surface Power: Preliminary Boiler Investigation,” Los Alamos National Laboratory document LA-UR-04-4600.

Shaffer, C.J., M.T. Leonard, DV Rao, B.C. Letellier, A.K. Maji, and A. Ghosh, “GSI 191: Experimental Studies of Loss-of-Coolant-Accident-Generated Debris Accumulation and Head Loss with Emphasis on the Effects of Calcium Silicate Insulation,” Los Alamos National Laboratory document LA-UR-04-1227.

Shaffer, C.J., and B.C. Letellier, “GSI-191 Technical Study: Detailed Blowdown/Washdown Transport Analysis for Pressurized-Water-Reactor Volunteer Plant,” Los Alamos National Laboratory document LA-UR-04-4338.

Sheldon, K.E., C.M. Anderson-Cook, and W.F. O’Brien, “Using Computer Modeling to Optimize Cost and Maintain Performance Constraints for Production of Aircraft Turbine Engines,” Los Alamos National Laboratory document LA-UR-04-5307.

Shevitz, S., and L. Luck, “Fragment Impact Scoping Toolkit,” Los Alamos National Laboratory document LA-UR-04-4806.

Siebe, D.A., C.J. Shaffer, and K.S. Kim, “Analysis of Reactivity Excursion in DAF Assembly Cells,” Los Alamos National Laboratory document LA-CP-04-0650.

Siebe, D.A., “Modeling Sensitivity Study for Building Leak Path Factor Calculations Using MELCOR,” Los Alamos National Laboratory document LA-UR-05-0031.

Siebe, D.A., and H. Jordan, “A Coupled Wind-Driven Leak-Path-Factor and Dispersion Analysis,” Los Alamos National Laboratory document LA-UR-05-0166.

Silver, G.L., and C.M. Anderson-Cook, “Hydrogen Generation in the Nitric Acid Solution of Plutonium,” Los Alamos National Laboratory document LA-UR-04-7572.

Spore, J.W., D.A. Siebe, and J.F. Lime, “Completion Report for Fin. No. Y6583, Task 7.0, Multi-Non-Condensable Gases Model,” Los Alamos National Laboratory document LA-UR-04-2254.

Spore, J.W., and J.F. Lime, “Completion Report: Development of Perl Script to Run RELAP5, SNAP, and TRACE in a Batch Mode,” Los Alamos National Laboratory document LA-UR-04-2253.

Spore, J.W., D.A. Siebe, and J.F. Lime, “Implicit Energy Exchange between HS and Fluid Components,” Los Alamos National Laboratory document LA-UR-04-5694.

Stephens, T., L.M. Moore, A. Labouriau, W. Hollis, K. Hakonson, J. Schoonover, and N. Leyva-Estrada, “S5370 Silicone Foam Aging Studies,” Los Alamos National Laboratory document LA-UR-04-1912.

St. Ledger, J., “Java Tools Training,” Los Alamos National Laboratory document LA-CP-04-0464 (June 2004).

Tandon, L., J. Eglin, S. Michalak, S., D. Temer, D. Jackson, and R. Picard, “Plutonium Metal Exchange Program: Current Status and Statistical Analysis,” Los Alamos National Laboratory document LA-CP-04-4515 (2004).

Thompson, D., B. Bush, and D. Powell, “CIP/DSS Model Development Plan,” Los Alamos National Laboratory document LA-UR-04-6148 (September 2004).

Trellue, H.R., “Modification of MONTE-BURNS to Evaluate Space Reactors at Criticality throughout the Burnup Cycle,” Los Alamos National Laboratory document LA-UR-04-7060.

Trellue, H.R., “Use of MCNPX/CINDER90 for Residual Nuclide Production/Decay,” Los Alamos National Laboratory document LA-UR-04-8433.

Trellue, H.R., “Safety and Neutronics: A Comparison of MOX vs. UO2 Fuel,” Los Alamos National Laboratory document LA-UR-04-8514.

Waters, L.S., “MCNPX Guarantee,” Los Alamos National Laboratory document LA-UR-04-0902.

Wendelberger, J.R., and J. Huckett, “Development of a Test Plan for

Repeated Measures Data," Los Alamos National Laboratory document LA-UR-04-7039.

Williams, R.B., "Restricted Complexity Framework for Nonlinear Adaptive Control in Complex Systems," Los Alamos National Laboratory document LA-UR-04-0903.

Williams, M., M. Brown, B. Singh, and D. Boswell, "QUIC-PLUME Theory Guide," Los Alamos National Laboratory document LA-UR-04-0561 (2004).

Wilson, A.G., and K. Sentz, "Belief Functions and Probabilistic Thinking," Los Alamos National Laboratory document LA-UR-04-7151.

Wilson, A.G., L. McNamara, and G. Wilson, "Information Integration for Complex Systems," Los Alamos National Laboratory document LA-UR-04-6564.

Wilson, A.G., T.L. Graves, N. Hengartner, R. Klamann, A.C. Koehler, G. Anderson, K. Deal, and G. Lopez, "Development of an Integrated Stockpile Reliability Model for the TOW Missile," Los Alamos National Laboratory document LA-CP-04-0844.

Wilson, A.G., and A.C. Koehler, "Munitions Stockpile Reliability Assessment," Briefing for Joint DoD/DOE Munitions MOU TCG-XIV Meeting, Los Alamos National Laboratory document LA-UR-04-8111.

Wilson, A.G., "Information Integration Technology," Briefing for BMDS On-Alert Capability Assessment Team Meeting, Los Alamos National Laboratory document LA-UR-04-7276.

Wilson, A.G., "Munitions Stockpile Reliability Assessment," Briefing for LANL High Explosives Working Group, Los Alamos National Laboratory document LA-UR-04-3553.

Wilson, A.G., N. Hengartner, and A. Koehler, "Munitions Stockpile Reliability Assessment," Briefing for Joint DoD/DOE Munitions MOU TCG-XIV, Los Alamos National Laboratory document LA-UR-04-3261.

Wilson, A.G., C.S. Reese, M.S. Hamada, and S. Keller-McNulty, "Reliability Overview," Briefing for Surveillance Review Committee, Los Alamos National Laboratory document LA-CP-04-0437.

Wilson, A.G., S. Keller-McNulty, and M.S. Hamada, "Briefing for Enhanced Reliability and Systems Modeling," Enhanced Surveillance Campaign Annual Review, Los Alamos National Laboratory document LA-UR-04-3268.

Zerkle, D., "Binder Decomposition, Binder Migration, and PBX 9501 Permeability," Los Alamos National Laboratory document LA-UR-04-7707.

Zhang, J., "A Model on the Oxidation Processes of Steel Exposed to Lead Alloy with Oxygen Control," Los Alamos National Laboratory document LA-UR-04-2689.

Zhang, J., and Y. Jiang, "A Dissipative Particle Dynamics Study of the Phase Behavior of Phospholipids," Los Alamos National Laboratory document LA-UR-05-0261.

Zhang, J., and N. Li, "Oxide-Layer Growth Model of Steels in Liquid Lead-Alloy Systems," Los Alamos National Laboratory document LA-UR-05-0555 ■

Notes

Los Alamos
NATIONAL LABORATORY
EST. 1943

Los Alamos, NM 87545

Decision Applications Division • (505) 667-4567 • dweb@lanl.gov